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The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XL NO. 10

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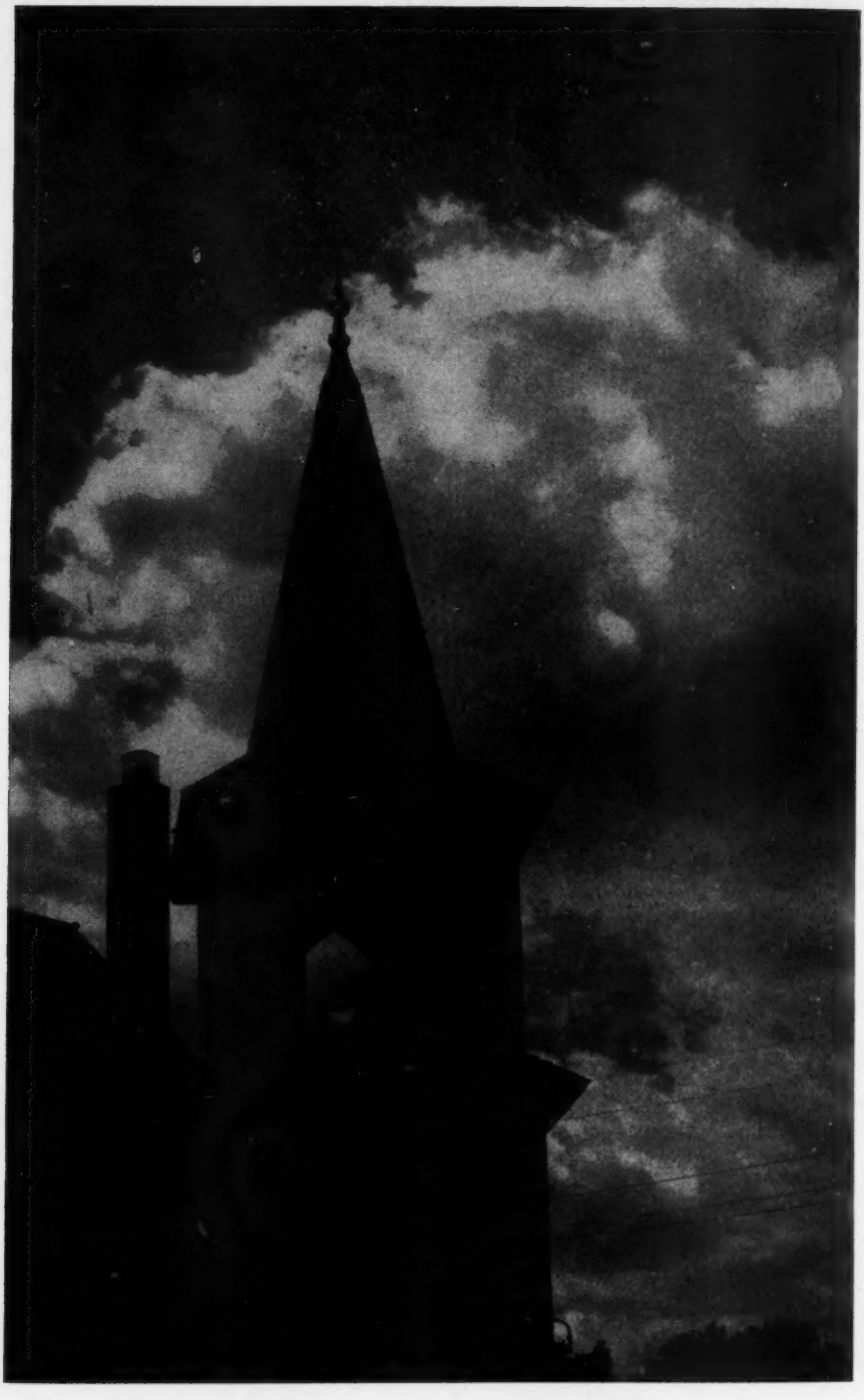

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Better Crops with PLANT FOOD

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VOL. XL WASHINGTON, D. C., DECEMBER 1956 No. 10

We're Back Again To . . .

Hearts and Hollytime

Jeff McDermid

(ELWOOD R. MCINTYRE)

IT'S always seemed to me that Christmastime is a sort of sanctuary, a refuge through holly-decked doors to which we may sojourn for a short season from the cares and mistakes we have made during the closing year. Then the cherished ones seem nearer and dearer, and those whose lives have enriched us in the years that are gone come back to reach us lovingly through the spruce boughs and the candle shine.

Christmas is a joyful time of remembrance. Most important of all things to remember is fittingly said in this little verse, the soulful author of which remains obscure and unknown:

Go now to those you love in any way and say "I love you" for your gentle grace, your pixie charm;

I love you for that day we knelt beside the brook and watched the race of ripples down the stream.

Say to your friend "You are my friend!" And to the hearts that know your heart, "I love you that you understand."

Tell *all* your loves *your* love—before you go! For in departing, whether Time or Fate or Death should close the door,

That love is *lost* that is *not said*, and on the heart the weight of new regrets lies far beyond their cost . . . .

The things you *might* have said and *might* have done, that now can *nevermore* be said or done!

Through these pleasant columns it has been our privilege to celebrate Christmas for more than thirty years. In many of those eager essays of ours it was customary to regard Christmas solely as a season when infants and youth had priority. Sharing of their

juvenile joys dictated most of those mellow sentiments. Yet as one grows older in years and meets weakness and frustration, the common lot of elderly observers, it seems somewhat artificial to indulge in the vivid and carefree Christmas outlook which comes as a birthright to those of tender years, bright hopes, and boundless energy.

AT any rate, one wishes in these festive seasons to relive the pleasures of the past without regret and without reproach. Under this spell of holiday glee, you desire to stay green and growing like the needles of a pine amid the cheer—rather than to wither and fade away like a brown leaf on a deciduous tree whose brief term of summer usefulness is past.

The best way to achieve this state is to stop regarding the rising generations behind you with envy. Gaze instead at folks as though you also were in tune with the times and alert to the advantages we mutually possess. To do this is to escape the dreary fear of being so soon forgetful and forgotten, obliged to cling to ancient memories and scan old scrapbooks of an era that is gone.

Happiest and most serene in the downward journey on the plane of life is he who can forget the bumps and jar of travel by searching for familiar scenery, and seeing in it new improvements and fragments of the old, bright, rainbow-tinted dreams, once thought intangible, but which now are come to pass.

New faces and old incidents are not contradictory. Old plans and new ones have much in common. Old ways of saying kindly things will never change in spite of unfamiliar styles, new goals, and modern marvels. Old messages of cheer and sentiment returning from the scroll of time find quick response in human hearts today.

This theme is one to follow in a back glance at the things expressed before—an idle retrospect to thoughts of former Yuletides. Figments of fancy woven here are partly those we've said before, but may be used again for want of any better or more appropriate.

Few of us know who invented Christmas in the first place. Possibly a weary group of emaciated victims of Roman cruelty, or perchance a few jolly, rotund priests and monks in the Alpine valleys of the Austrian Tyrol; or maybe big, red-jowled Saxon barons bringing in the boar's head for a night of sac and ale and greasy gormandizing. It makes but little difference now who got the first idea of this pagan feast that later was taken over by the bands of broken but faithful followers of Jesus.

The main thing and the most astounding proof of the strength of the Religion of Love are simply that it survives and wins against all the ruin and ravage aimed at gentleness and decency, from the Huns to Hitler. No other date is so defiant of disaster and so resistant to attack as our symbolic date of December 25.

Christmas is always a source of calm and peace and charity. As you sit with your wife before the glowing hearth, surmounted by its holly fringe and row of hopeful hosiery, listening to carolers along some distant street, you are not so apt to blame the world for its sins as you are to thank it for its signs of faith and charity.

YOU recall that when we were very young the uplift of these holidays mingled with delightful mystery and childish expectations. Before my tenth year I had absolute and implicit faith in the jingling journey of the whiskered saint. I never allowed any apparent physical improbabilities to blast my confidence. I may have wondered why Santa Claus brought me the same kind of sugar cookies cut with the crinkly tins my Mother used. I may have wondered also why most of the packages left for me bore trade labels and price tags from Arthur & Johnson's, when my faith told me that they must have been made by gnomes at the Arctic Circle. Even when at our Sunday School gift night I surprised our husky local blacksmith in the choir room as he wriggled his corpulence

into a red suit trimmed with white braid and donned his cotton beard—yes, even then I remained in rebellion against a sneaking surge of unbelief.

Finally we put on long pants and had socks too short for holding presents. Our voice was changing and we went to grammar school and belonged to the fifth ward gang. We fed up mentally on Cooper, Henty, Cap Merrywether, and Robert Louis Stevenson.

Then we knew all there was to know and considerably more—some of it not

fit to repeat. We were proud of black eyes and grubby knuckles and marble bagfuls, and equally ashamed and dispirited by poor report cards or muffing a ball at first base.

We ranged afield with air gun and fish pole. Our pockets bulged with artful barter and boyish treasures of little consequence. We were chummy with freckled, ragged boys of no exceptional ancestry. We were followed home by mangy yellow pups and chased from apple orchards by grim old-timers.

That was the age of utter independence and puckish nonchalance for a boy. It was a time when even Christmas took a back seat for awhile. He didn't know it then, but he had ahead of him a lot of stuff harder to accept than Santa Claus. He thought he wasn't going to stick to fairy tales. He was sure he wasn't hanging up "no socks no more." He was out to hang up a record. He imagined that he had put off childish things, and no longer "spake as a child or thought as a child." He was just fooling himself when he believed there was no magic and mystery in Christmas. It all came back to him later, as it most always does.

AS soon, however, as our boy meets the girl of his choice, back comes the whole troop of holiday sentiments and programs. Those Christmas ideals creep back into his breast to warm his heart and make him generous.

That changed fellow will always remember the first Christmas eve spent with his young wife and their first baby. There was not always so very much left from his modest earnings with which to make merry but you remember how he felt, don't you? You knew at least that you and yours were not knocking at an overcrowded inn. You knew that your credit with the milkman and the grocer was ace-high. When the kids multiplied and the tots became toddlers, you assumed the role of old Santa yourself, just as your Dad had done with less to spend.

On the receiving end, you remember, under straightened circumstances, were those rancid cigars, wrinkled neckties, cheap watches, and bargain counter perfumery. You overcame your doubts by recalling that the wondrous gifts pictured in the slick magazines were not meant for a subordinate clerk with two babies, a hopeful wife, a yawning furnace, and a hefty mortgage. It was a time of slaying economic dragons with a moment or two spent in Christmas mirth. You took it in your longest stride, up there in the tiny flat or maybe the rented farm. You forgot the visions of fish-pole days and began in dead earnest to face the world as it came along, being certain of the encouraging handclasp of the finest little Mary since the time of the Manger.

So then it was that we newlyweds said: Come, my friends, smuggle those mysterious bundles into the house through back door or cellar window; hide them in locked drawers or leave them awhile at the neighbors until the hour arrives when the little tree will be trimmed and the inquisitive children unwillingly will be forced to

(*Turn to page* 52)

Fig. 1. Effect of potash applications upon the stand of alfalfa at Greenville, Kentucky. The plot on the left received an initial application of potash at the rate of 300 lbs. of K_2O per acre. No potash was applied to the plot on the right.

Fertilizing Alfalfa in Kentucky*

E. C. Doll and H. F. Miller

University of Kentucky, Lexington, Kentucky

PROPER fertilization and management practices for alfalfa are of the utmost importance if high yields are to be obtained. Alfalfa grows best in a deep, well-drained soil, but Kentucky farmers are now finding that plantings have failed on some soils primarily because of low levels of lime, phosphate, and potash rather than undesirable physical characteristics. Although the planted acreage of alfalfa is nearly five times as great today as it was 30 years ago, the potential alfalfa production in Kentucky is still far from being reached.

In the summer of 1949, an experiment was started near Greenville in western Kentucky to determine the effects of phosphorus and of various initial rates of potassium on the yield and maintenance of stands of alfalfa. The experimental area is located on Tilsit silt loam—an acid soil derived from underlying sandstones and shales. This soil is naturally extremely deficient in phosphorus, is low in potassium, and has a well-developed, strongly acid hardpan at depths of from 18 to 25

* The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the Director.
Photos by H. L. Garrard.

inches. Prior to starting the experiment, the soil of the experimental area had a pH value of approximately 5.8, contained 30 lbs. per acre of available phosphorus (as measured by a modified Truog method), and 50 lbs. per acre of exchangeable potassium. Above 50 lbs. available phosphorus (P) and 200 lbs. available potassium (K) per acre by soil tests would be considered as adequate.

Ground limestone at the rate of three tons per acre was applied to the entire area. The fertilizers were broadcast and disked into the surface soil prior to seeding. The rates of phosphate and potash are given in Table I. Boron was applied to all plots at the rate of 20 lbs. of borax per acre. No nitrogen has been applied to these plots other than a light application at the time of seeding. In August 1949, 15 lbs. of Atlantic alfalfa and 3 lbs. of bluegrass per acre were seeded. In the latter part of September, there was a good stand of alfalfa on all plots, but by November the stand on the plots which received no phosphate had thinned out considerably and the growth on these plots was definitely poorer than that on the plots which had received applications of both phosphate and potash.

Significant Early Responses

The first year, a significant response was obtained for each additional increment of potash and for phosphate for each of the three cuttings. Field observations made throughout the summer indicated that the response to potash became relatively greater as the season progressed. On the low-fertility plots the alfalfa did not recover after the third cutting in 1950, and most of the stand was lost during the following winter. On other plots receiving still smaller amounts of potash (33 lbs. annually) than shown in Table I much of the stand of alfalfa was lost after the first cutting. Therefore, the experimental area was plowed and reseeded during the summer of 1951, and fer-

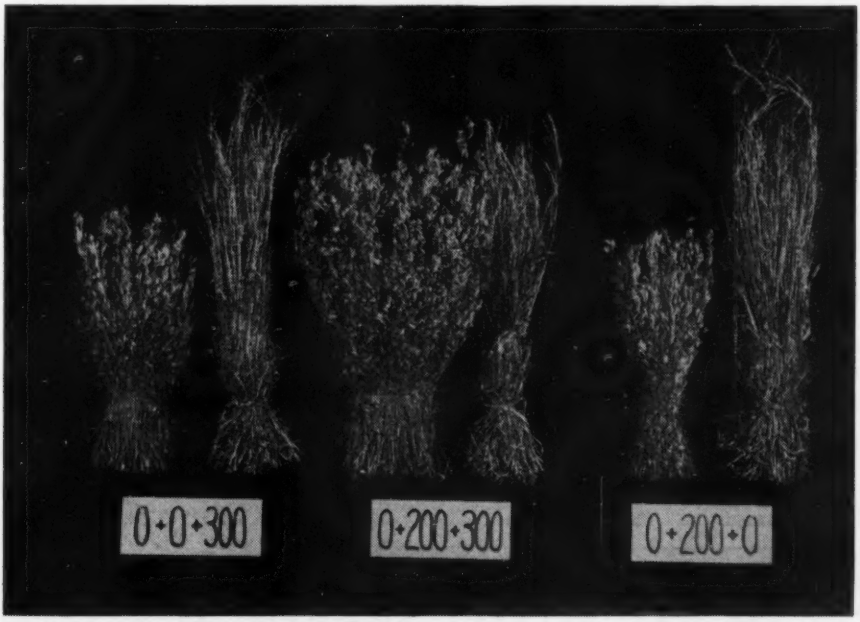

Fig. 2. At the time of the third cutting of hay in 1954, the botanical composition of the herbage was determined from plots which received applications of either phosphate or potash alone and from those plots to which both fertilizer elements had been applied. Field observations indicated that there were proportionately fewer weeds in the third cutting than in either the first or second cutting.

TABLE I.—EFFECTS OF PHOSPHATE AND OF VARIOUS RATES OF POTASH ON THE AVERAGE ANNUAL YIELDS OF ALFALFA AT GREENVILLE, KENTUCKY, FOR A PERIOD OF FOUR YEARS.

Initial rate of fertilization*		Yield of field-cured hay Year				Average
P_2O_5	K_2O	1950	1952	1953	1954	
lbs/A	*lbs/A*	*lbs/A*	*lbs/A*	*lbs/A*	*lbs/A*	*lbs/A*
200	0	8,350	3,090	4,320	4,560	5,080
200	100	9,730	3,390	6,240	6,510	6,470
200	200	10,910	3,630	7,010	8,530	7,520
200	300	11,970	4,210	8,320	9,390	8,460
0	300	9,120	2,360	4,120	4,840	5,110
LSD						
	.05	310	N.S.	1,210	1,820	640
	.01	410	N.S.	1,680	2,530	850
C.V.		9.3	15.0	10.7	13.4	10.9

* Applied in summer of 1949 and again in 1951.

tilizers were again applied at the original rate to the respective plots. At that time an excellent stand of alfalfa was obtained and was satisfactorily maintained on the better plots through the 1954 season.

Fertilizers Save Stands

The average yields for each year and the average annual yields for the four years of the experiment, given in Table I, show that excellent yield responses to both phosphate and potash have been obtained each year. For the four-year period, the annual response for each additional increment of potash has been highly significant. Three cuttings of hay were obtained in 1950; one in 1952, two in 1953, and three in 1954.

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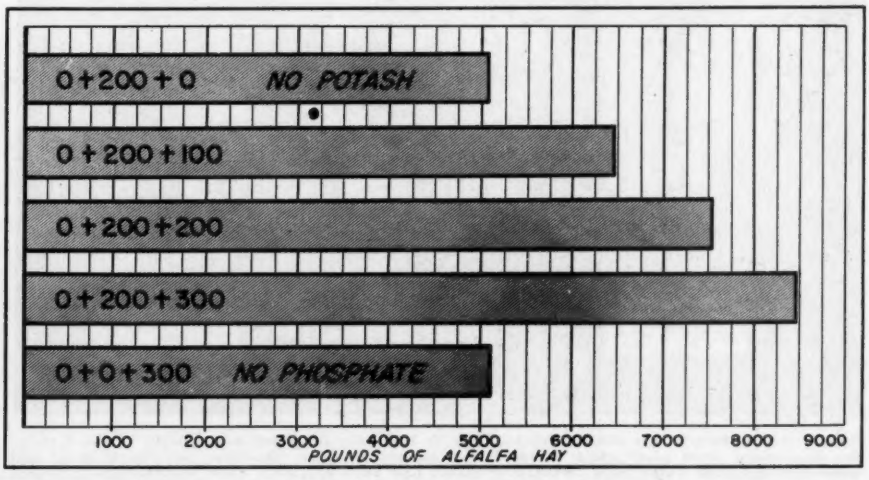

Fig. 3. Illustrating 4-year average yields of alfalfa from different amounts of phosphate (P_2O_5) and potash (K_2O) as shown in Table I.

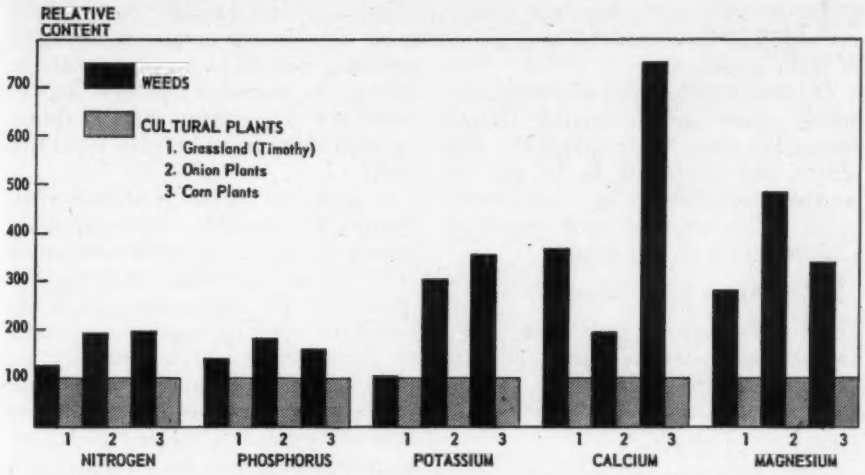

Fig. 1. Weeds are represented as having a greater mineral content than their associated cultural plants. The cultural plants have been given the value 100. Average data of 1950-1951. Samples collected from typical farms in the Connecticut Valley, Massachusetts.

Weeds—Robbers of Our Farms

By Jonas Vengris

Department of Agronomy, Massachusetts Agricultural Experiment Station, Amherst, Massachusetts

WEEDS are undesirable plants that interfere with agricultural operations, increase labor requirements, add to costs, and reduce yields.

From a biological point of view, weeds are plants that associate themselves with cultural companion plants. Companion cultural plants may be compatible, beneficial, or even necessary for normal weed growth. Weeds are as old as agriculture itself. Through the years, many different weeds have adapted themselves to the specific conditions in which cultural plants are grown. Some of the weeds follow certain agricultural plants wherever they are raised and so become cosmopolites—for example, lamb's-quarters (*Chenopodium album*) and chickweed (*Stellaria media*).

In some cases, the adaptability of weeds has gone so far that they would not be able to survive without companion cultural plants—for instance, cheat (*Bromus secalinus*) in winter rye. Such plants are obligatory weeds and might be called domesticated plants. Thus, the borderline between cultural plants and weeds is often indefinite; our barley, wheat, soybeans, and flax all were once weeds or wild plants. *Avena strigosa* Schreb., formerly widely known in parts of Europe as a cultural plant, escaped and now often appears as a wild plant or weed again. And there are quite a few plants that we ourselves call weeds one day and cultural plants another, for example, sweet clover (*Melilotus alba*) and winter vetch (*Vicia villosa*). In short, the

plants we call weeds comprise a very heterogeneous and indeterminate group of plant species.

Of about 1,200 species of plants commonly called weeds in the United States, less than 30 are sufficiently persistent and aggressive to be able to survive indefinitely on crop-rotated land. They are the most important troublemakers on our farms.

More Data Needed

On arable land as well as on grassland, weeds grow alongside cultural plants and often constitute 30 to 50% of the total dry matter production.

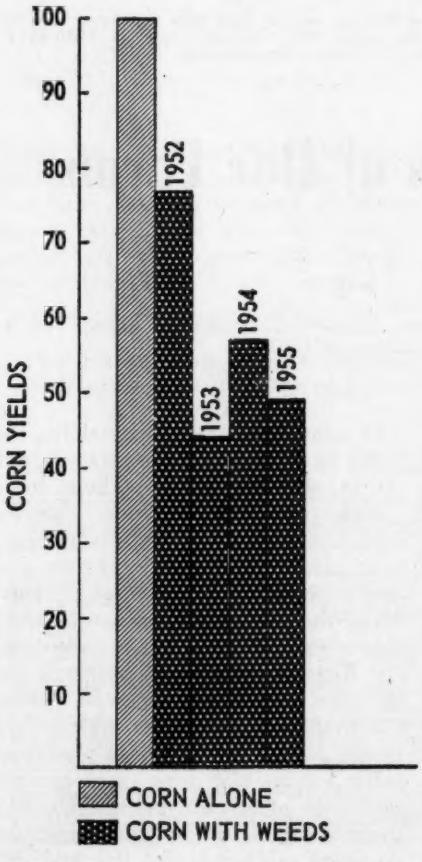

Fig. 2. Yields of corn grown alone and corn grown with weeds 1952-1955. Relative values, corn alone=100. Plots were fertilized 200 lbs/A N, 200 lbs/A P_2O_5, and 200 lbs/A K_2O.

Therefore, the competition between these two groups of plants for light, moisture, and plant nutrients must be strong. In general, it should be kept in mind that, in practice, there is almost no such thing as completely weed-free land.

A study of weeds as serious competitors for essential nutrients, moisture, and light with their companion crop plants has long been needed. There are only a few references in the literature dealing specifically with weeds as important competitors for plant nutrients. It was for this reason that a project to study the competition between weed and cultural plants for plant nutrients was undertaken a few years ago at the Massachusetts Agricultural Experiment Station. Dry matter yields and chemical composition of weeds and cultural plants were determined to evaluate the extent of weed competition with cultural plants. Of all the important Massachusetts field crops studied, field corn was the one most thoroughly investigated.

Chemical Composition

Studies on the chemical composition of cultural plants and companion weeds produced some interesting information. In general, in the grasslands as well as in cultivated fields weeds are major competitors with cultural plants for nitrogen and especially for potassium (1, 2, 3). Both nutrient elements are often limiting factors in crop production. Certain weeds are often able to accumulate considerable amounts (Fig. 1) of these nutrients at the expense of cultural plants, thereby reducing yields, especially when the availability of these elements in the soil is low (Tables I and II). Every farmer should bear this in mind.

High phosphorus accumulation in weeds indicates that weeds are competing with cultural plants for this element, especially when quantities of available soil phosphorus are low. On the other hand, high phosphorus level in weeds, even where levels of available

TABLE I.—CHEMICAL COMPOSITION OF CORN GROWN ALONE, CORN GROWN WITH WEEDS, AND DIFFERENT WEEDS GROWN WITH CORN. DATA ARE AVERAGES FOR 1952-1955. PLOTS RECEIVED 200 LBS/A N, 200 LBS/A P_2O_5, AND 200 LBS/A K_2O.

Plant	Early maturity stage of growth				
	N%	P%	K%	Ca%	Mg%
Corn alone	1.46	0.20	1.04	0.17	0.27
Corn with weeds	1.38	0.19	0.76*	0.20	0.36*
Pigweed with corn	2.41	0.26	2.79	0.62	0.93
Lamb's-quarters with corn [1]	2.64	0.20	2.50	0.75	0.75
Crabgrass with corn [2]	2.09	0.20	1.80	0.38	0.96
Averages for weeds	2.38	0.22	2.36	0.58	0.88

[1] One year's data only.
[2] Two years' data only.
*Significant in comparison with corn grown alone.

phosphorus in the soil are low, indicates an ability on the part of many weeds to utilize forms of soil phosphates that are relatively unavailable to many cultural plants. The role of some plant species in releasing phosphorus that is not readily available to other plants in the soil has not been appreciated.

Of course, substantial differences exist even between various weeds. Weeds with high feeding power for essential plant nutrients usually invade depleted, run-down land and thrive normally under poor fertility levels where cultural plants show deficiency symptoms and fail to produce normal yields. This helps us to understand why an infestation of certain weeds usually occurs on soils depleted in fertility. Under the conditions of one experiment, wormseed mustard (*Erysimum cheiranthoides*) exhibited a strong feeding power for phosphorus when compared with companion crops of alfalfa and smooth bromegrass (1). Both smooth bromegrass and alfalfa showed a marked increase in phosphorus content with phosphorus fertilization, but the wormseed mustard showed no response to 500 pounds of 20% superphosphate to the acre and only slight response to 2,000 lbs. of superphosphate. On the other hand, we have many common weeds that are typical to highly fertile soils. Pigweed (*Amaranthus retroflexus*) is a typical weed found in good soils with

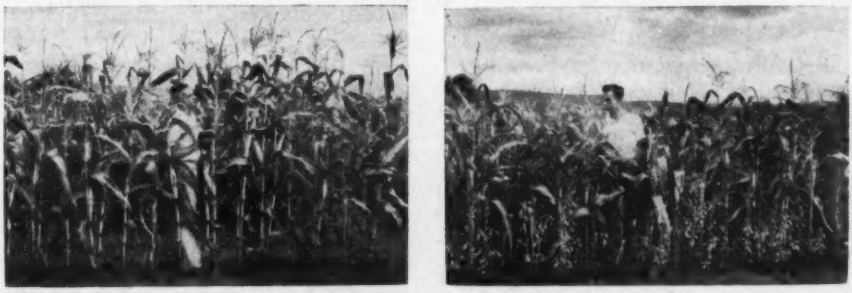

Fig. 3. In the clean field at left, corn has no competition for nutrients and moisture. In the field at right, weeds are competing so strongly that the corn is suppressed and yield is decreased. Photo by John H. Vondell.

TABLE II.—COMPARISON OF RELATIVE YIELDS AND PLANT NUTRIENT UPTAKE BY CORN ALONE, CORN WITH WEEDS, AND DIFFERENT WEEDS GROWN ALONE. CORN GROWN ALONE=100. PLOTS RECEIVED 200 LBS/A N, 200 LBS/A P_2O_5 AND 200 LBS/A K_2O. DATA ARE AVERAGE FOR 1952-1955.

Plant	Relative nutrient uptake Corn = 100					
	Yields	N	P	K	Ca	Mg
Corn alone	100	100	100	100	100	100
Corn with weeds	57	53	58	44	66	76
Pigweed alone	60	102	80	124	275	234
Lamb's-quarters alone [1]	69	120	74	121	281	216
Crabgrass alone [2]	67	100	64	157	131	228

[1] One year's data only.
[2] Two years' data only.

an abundance of easily available plant nutrients. It is noteworthy that this weed, as our 1952-1953 tests showed, could hardly establish itself at all even when planted on soils low in available phosphorus (2).

Weeds in general, and especially dicotyledonous ones, have a rather high mineral content. They are able to accumulate about as much calcium and magnesium as legumes and as large or larger amounts of potassium as the grasses. In short, we may look on weeds in general as being comparatively rich in minerals. Their value as a feed, so far as they are palatable, should not be underestimated. Often we look with astonishment at the cows that leave lush grass-legume pasture and go to the adjacent run-down grassland to get some "dessert," rich in minerals and vitamins.

Corn and Weeds

Recently, the question has been raised about the possibilities of growing field corn without any cultivation. It was thought that on liberally fertilized land corn even when grown with weeds might have enough nutrients to produce maximum yields. Thus, we might save cultivation and weed control expenses. Besides, accompanying weed growth controls soil erosion and adds additional organic matter to the soil. Although heavier rates of fertilization would be required to supply the nutritional requirements of both the corn and the weeds, the additional cost of the fertilizer would be more than offset by the savings made in eliminating certain tillage operations.

In order to collect some data pertaining to the competition between weeds and field corn and to the possibilities of raising corn successfully in association with accompanying weeds, the investigation was started.

When studying competition between weeds and corn (1952-1955) in field test plots, corn was grown in clean, pure culture and in a mixture of corn with common corn weed species. In 1952-1953, for comparison, weeds were seeded in rows 20 inches apart, each thinned to a uniform stand. Plots planted to corn, as well as those planted to corn with weeds, were cultivated, but the weeds in the corn-with-weed plots were left to grow in the rows surrounding the corn plants.

Table I lists the chemical composition of corn grown alone and corn grown with weeds, as well as of various weeds grown with corn. The data reveal an interesting point: when corn is grown with weeds, competition for potassium is most noticeable. The dif-

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A Look at the Orient

By Firman E. Bear

Editor, Soil Science, Rutgers University, New Brunswick, New Jersey

SOME 45 years ago F. H. King, Professor of Soils at the University of Wisconsin, wrote a world-famous book called "Farmers of Forty Centuries" in which he described in detail the farming practices in China, Korea, and Japan. This book was written around a controversy between Milton Whitney of the U. S. Department of Agriculture and Cyril G. Hopkins of the University of Illinois. Whitney believed that unproductiveness of cropped soils was due to the accumulation of toxic substances excreted by each crop plant and injurious to that species of plant. This toxicity could be overcome by crop rotation and by the use of fertilizers, which served primarily as detoxifying agents.

Sharply Defined Issue

To Hopkins, this was heresy. He had reduced the soil fertility problem to a bank-account system. Each acre of soil contained a determinable amount of the essential nutrient elements. Each harvested crop consumed some of these supplies. One could calculate the number of years the supply would last. To avoid soil exhaustion it was necessary to return as many pounds of these essential elements to the soil as the crops removed. This called for growing clover to accumulate nitrogen, applying limestone to keep the soil sweet, and adding phosphorus and potassium fertilizers to replace the loss of these elements.

The issue was so sharply defined that it led to a Congressional investigation of the teachings of Whitney and his associates. A popular article dealing with this controversy, written by F. I. Anderson and published in *Everybody's Magazine,* pointed up the problem. Anderson explored Hopkins' concept of the bank-account approach to the fertility problem, reviewed the matter of mineral deposits required for fertilizer purposes and the possibility of their exhaustion, and dealt with the doleful prophecies that "the hungry world marches forward in numbers, its appetite increasing in geometric ratio." This article was subsequently published in book form under the title "The Farmer of Tomorrow." Concerning Hopkins' concept, the author concluded:

"This is not an illusory hypothesis. It is the accepted theory and practice of the civilized nations of the world, with the single exception of China, where agriculture has been going on for *forty centuries*; and her acres are still feeding a population fifteen or twenty times as dense as our own, without regard to potash and phosphorus in chemical form."

Starts Investigation

King decided to go to China to investigate this matter. Anderson's statement gave him the title for the book he wrote on his return. In this book he told of the struggle for existence in these old and densely populated countries. Food shortages and famine were never far away. Every bit of human and animal excreta in the city, town, and country alike was religiously saved and applied to the soil. Large tonnages of canal mud were applied to the land. The sweepings of city streets and the clay of which they were made were hauled out to the farm. And even the soil itself was rotated between mulberry orchards and rice paddies.

King concluded that by the Chinese system, a highly laborious and unsanitary one, fully as many pounds of plant

nutrients were returned to the soil as the harvested crops removed. This system was one of conservation. The fertilizer system, such as we employ, is far less laborious and much more sanitary, but it is one of exploitation of our mineral resources, which may be exhaustible. But the end results in terms of crop production are virtually identical.

Ever since King's book came over my desk, which was shortly after its publication in 1911, I had been looking for an opportunity to get a close-up view of the Orient. Finally, it came, and my wife and I set out on a 63-day trip around the Earth by air, stopping at the Hawaiian Islands, Japan, the Philippines, Hong Kong, Thailand, India, Pakistan, Lebanon, and Jordan, with short stops in a number of other countries in between and on beyond.

Nine weeks is a very short period in which to see the Orient and circle the globe. But one loses very little time traveling by air from one country to the next. And he often gets an excellent view of the land beneath while he is doing it. More than eight weeks were spent on the ground, walking about, traveling by auto and train, talking with people, and watching them at their work. And everywhere we went zealous American agricultural missionaries, many of them old friends of mine, were busily engaged with programs designed to increase production and improve the lot of those who till the soil.

Over-population

The primary problem of the Orient is over-population. Japan, with a total land area of 91 million acres, of which only 12½ million acres are in crop production, has a population of 85 million, and this is increasing at the rate of more than a million a year. At equal population density we would have nearly 1,900 million people, which is more than 11 times our present 168 million. And we harvest crops from 350 million acres of land every year.

India, with a land area of 678 million acres, about one third that of continental United States, has a population of 380 million. Communist China, with 2,375 million acres of land, which is about 25 per cent more than that of the United States, has an estimated 583 million people, and the number is increasing at a rate of possibly 12 million yearly. More land could be brought into production in both India and China if modern soil-manipulating machinery were available for use. But the indications are that if more food was made available, the rate of growth of the population in these countries would increase correspondingly.

Parts of Japan and India were observed in considerable detail. Our view of Communist China had to be from across a barbed wire barricade from Hong Kong. But we saw enough of the Orient to confirm our belief that the Malthusian principle is as sound today as it was when first promulgated by Thomas A. Malthus in his "Essay on the Principle of Population," published in 1798. This principle is that the ultimate controls of population are famine, pestilence, and war. One sees these controls in operation in these Oriental lands.

Inadequate Diet

The people of India, China, and Japan have, on the average, a 2,000-calorie diet, in which only 5 to 10 per cent of their protein is of animal origin. When one sees a laborer squatting on his heels along the highway or asleep in the shade of a tree, he should realize that this man is conserving his energy. He must rest and sleep as much of the day as possible. In contrast, we enjoy a 3,200-calorie diet, with nearly 60 per cent of our protein from animal sources.

In every Oriental country large acreages of land are being farmed with a high degree of efficiency, as measured by acre yields. But most of the farming is being done by peasants who know the art rather than the science of agriculture. They do surprisingly well in spite of educational handicaps. One is

impressed, however, that the agricultural system is designed to keep a lot of people busy rather than to economize on labor. In India over 60 per cent of the people are engaged in agriculture in comparison with about 15 per cent in this country.

Compulsory Education

Except for Japan, a primary need of all these Asiatic countries is compulsory education. Fairly good progress is being made in this connection but they all have a long way yet to go. This applies particularly to the mud-hut villages in which the country people live. If the boys and girls were taught to read and write so they could think and act more effectively on their own behalf, conditions should improve more rapidly. Out of such thought might come the widespread realization, as is now the case generally in Japan and with the better educated classes in India, that the best answer to too little food for too many people lies in population control.

Over-population reduces efficiency and does away with the dignity of labor. Division of labor is carried out to a fine point in India. One is troubled by the near futility of much of the very burdensome labor he sees being done. Gangs of men and women carry rock and soil in baskets on their heads for highway and dam construction. They are paid a mere pittance but even this is more than the work is worth. One man with a modern machine could easily replace 100 such workmen and do a better job in half the time.

I was particularly impressed by the high degree of intelligence of the men who were trained in philosophy and science in India. But the number of such men in relation to the total population is very small. By and large, these educated men live on an intellectual plane so far above that of the millions of impoverished peasants and city laborers that there is little or no meeting of minds. The upper classes, including Nehru himself, either fail to see or, if they do see, fail to show any great concern for the serious dilemma with which the lower classes are faced. The formal caste system has been abolished by law but the principle, in all its intricately troublesome details, still applies, and is likely to continue to do so for centuries yet to come.

A lot could be done for the people of India in a very short time if some way could be found to eliminate the useless members of the 200 million cattle family. But these cows, as well as many very troublesome monkeys, are sacred and must be permitted to die natural deaths. Thousands of unclaimed cattle roam the streets of cities and lie on the sidewalks. It is safer to run down a man with an automobile than to injure a cow or a monkey.

Religion—a Handicap

Religion, with its various formalities, fanaticisms, superstitions, taboos, fears, and other idiosyncrasies, is a very serious handicap to progress in most Asiatic countries. Except for the Philippines, the Buddhist, Hindu, and Islamic religions dominate the thinking of most of these peoples. Possibly Communism may now be considered the religion of China. A Christian Japanese girl said that the one fundamental difference between these Oriental religions and the Christian religion that dominates Europe and the Americas is that the followers of the former pray for themselves whereas the Christian prays for others. I am in serious doubt as to the truth of this observation.

It seems desirable in this connection to point out the particular importance to us of the Filipinos as allies. English is regularly taught in their schools and Christianity is their recognized religion. Thus we have much more in common with the people of the Philippines than with those of any other Oriental nation. English is widely spoken in other Asiatic countries, notably in India, but the religious beliefs and customs of these other countries constitute barriers that

are not easily surmounted.

One of the most troublesome of the many problems facing Asiatic nations is that of caring for the millions of displaced persons who live in squalid poverty in plain sight of the passerby. Many camps of such people are to be seen in India, Pakistan, Lebanon, Syria, and Jordan. Everybody knows, of course, that such problems are not confined to the Orient. Other millions in equally serious distress are to be found in the Russian-controlled parts of both Europe and Asia.

Most of the visitor's time in the Orient is consumed in visiting religious shrines, temples, palaces, and monuments, both ancient and modern. Some of them are extremely beautiful as, for example, the magnificent Taj Mahal of India. Many others are in a sad state of disrepair. Oftentimes the most interesting and impressive sights are the massive ruins of earlier civilizations, such as those in Cambodia, Lebanon, Jordan, Syria, and Greece.

Time Not Important

One often gets the impression that too many of the more intelligent of these people are living in the glories of the past rather than facing the realities of the present and the needs of the future. It is very difficult to reconcile the evidence of wealth of the cities of those ancient days with the even more evident poverty that now so widely prevails around many of these ruins.

The Oriental mind is conditioned to the ups and downs of civilizations. Time is not important. What can't be done today can be done tomorrow. By that time it may not need to be done. Few are particularly disturbed by widespread ignorance, poverty, disease, and other forms of distress. Everywhere our nation is held in awe, but not necessarily in high esteem. At the moment we are at the top of the heap, financially speaking, and in the outward standards of living of our people. But we are a young nation, unsophisticated and inexperienced. If the long history of these ancient peoples has taught anything it is that as it has happened to them so will it come to pass with us. And Arnold J. Toynbee, the world famous British historian, in his "A Study of History" is inclined to agree.

Symbolic of this philosophical state of mind is the string of beads one often sees Arabian men carrying about in their hands. These beads are not used in prayer, but merely as aids to contemplation. They are passed down from father to son, and their loss is irreparable. We might well find it worthwhile to adopt beads as a more refined replacement for cigarettes, chewing gum, toothpicks, or picking one's nose when he has nothing better to do.

By and large Oriental people are cordial, courteous, and helpful. They hope you will have a good opinion of them and their countries. They hope, also, that some of your gold will rub off on them. But if, for any reason, they feel that they are losing face, their attitude can change quite rapidly. And when their animosity is aroused, you may find yourself in the midst of a miniature holy war, with a marked tendency toward mob rule. But one can observe this phenomenon from place to place in this country as well.

Now for a few points picked up along the way that are of special significance to those who are agriculturally minded. In the Hawaiian Islands, most of the agricultural research is carried out by private experiment stations that are financed by growers' associations rather than by state or federal agencies. The Hawaiian Sugar Planters' Association and the Pineapple Growers' Association employ some of America's most capable soil-plant scientists, mostly from the mainland.

Leonard Baver, Director of Research for the Sugar Planters' Association, pointed out that no insecticides or fungicides have ever been used on sugarcane in the Hawaiian Islands. Insect

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Fig. 1. Left to right—Coastal Bermuda, Bahia, and Tall Fescue. They have one thing in common. They are all deep-rooted and produce tons of roots on every acre. SCS photo.

Roots Make a Difference

By Hugh J. Dowdle

Soil Conservation Service, Columbia, South Carolina

WHEN you want to find the answer to what makes plants "tick" as soil-holders and moisture-savers, you've got to look below the surface sod.

The "big three" grasses in the soil and water conservation program in the Southeast are Coastal Bermuda, Bahia, and Tall Fescue. They are quite different in many ways. But they all have one thing in common. They're all deep-rooted plants. Therein lies the secret of their success in soil conservation.

Bahia and Coastal Bermuda do well on a wide range of soils. Both are adapted to the light, droughty soils of the Coastal Plain. They also grow on the more fertile Piedmont soils. Bahia has a wider range than either Bermuda or Fescue. It will grow well on wet or dry sandy soils. Fescue is adapted to the more fertile moist soils and requires careful management.

Bahia and Tall Fescue are propagated by seed, Coastal Bermuda by stolons or roots. Fescue stays green throughout the winter, but Coastal Bermuda and Bahia grow only during warm weather. All three are readily eaten by cattle. So whatever soil conditions a farmer may have, one or more of the big three can more than likely provide an answer to his land and grazing problem.

Agricultural Research Service workers have actually measured the volume of dry matter in the roots of two of these grasses. They found the total weight per acre of roots of Coastal Bermuda was 5,278 pounds and of Bahia was 9,250 pounds. More than a ton

Fig. 2. This field planted to Fescue is safe from the driving force of raindrops, the cutting power of running water, and the blowing action of wind. SCS photo.

and a half of Bahia roots were found at a depth of one to four feet and slightly less than a ton of the Bermuda roots were found at this depth. However, on dry sandy soils both plants will send down roots to much greater depth.

The massive root systems of the "big three" are beneficial in both heavy clay soils and sandy soils. They have the ability to break up the heavy soils and to make the sandy soils stick together. This breaking up and sticking together brought about by millions of roots found on each acre planted to grass is the essence of soil and water conservation.

Under a sod of deep-rooted grass, the heavy soils soak up more water, the lighter soils hold a greater amount of the water they readily absorb. And under such sod all soils are tied down and protected from the driving force of raindrops, the cutting power of running water, and the blowing action of wind.

These and other grasses planted in rotation by conservation farmers do more than hold soil in place and conserve moisture. They will (1) aid in the control of plant diseases and weeds, (2) improve soil fertility and tilth, (3) make use of residual fertilizer elements, (4) increase the yields of following crops, and (5) furnish hay and grazing.

Experimental results show that feed for livestock grazed on these grasses, cafeteria style, costs less than equal amounts of feed nutrients produced from either hay, silage, or grain.

Natural draws sodded to any of the "big three" grasses form "paved" highways over which terrace water can run safely down the slope without washing the field.

The change to growing grass instead of fighting it in South Carolina began in a small way in the early thirties when a few progressive and farsighted farmers within the old demonstrational project areas, cooperating with the Soil Erosion Service, accepted grass as an ally in combating soil washing.

By the early forties, South Carolina was completely organized into Soil Conservation Districts and cooperating farmers were receiving technical help from the Soil Conservation Service for planning, applying, and maintaining the many practices that are needed in a soil and water conservation program. The growing of once-despised grass is

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BETTER SOIL—BETTER FEED

Part I—More Feed with Higher Nutritive Value Is Produced on Well-fertilized Than on Impoverished Soil

By W. B. Nevens[1] and E. B. Earley[2]

PRODUCING more per man, per acre, and per animal each year than the year before is the aim of nearly every livestock farmer. Along with this objective, most farmers strive for higher quality products and better market prices. Can a soil improvement program aid in reaching any of these goals and, if so, how?

Many Factors Affect Feeding Value of Crops

As soil-plant-animal relationships become better understood, it becomes increasingly evident that proper nutrition of animals is closely related to the plant-food supply of the soils on which feeds are grown. The type of soil and the kind and amount of fertilizer used are perhaps the two major factors affecting the value of a crop as feed. However, numerous other factors also play a part. Among these are kind and variety of crop, rainfall, atmospheric temperature, sunlight, length of growing season, stage of development of the crop at time of harvest, curing conditions, and crop pests (insects and plant diseases).

The relationship of the plant to the soil is not a simple one. Increasing the amount of available plant food in a soil which is deficient in some plant nutrient, for example phosphorus, usually brings an increase in yield but there may be no change or perhaps a decrease in the percentage content of that nutrient in the crop. Too high an acid condition or on the other hand the application of too much lime may slow up the release of certain plant-food elements. Because of such complex relationships as these and the wide variations in soils and climates, it is difficult to lay down hard and fast rules or even to make generalizations concerning the effects which may be expected from a particular form of fertilization. Through carefully controlled experiments, however, a number of soil-plant relationships which have an economic application to livestock farming have been definitely established.

Soil Treatment Improves Grasses

Changes in yield and nutritive value of grass pastures and meadows which are brought about by fertilization are striking examples of the effectiveness of a soil-improvement program. When fertilization is carried out just prior to or early in the growing season, noticeable effects are almost immediately apparent. This can be quickly and vividly demonstrated by applying nitrogen fertilizer or complete fertilizer in strips across the field to form letters, for example **N** for nitrogen and **F** for fertilized. The treated strips stand out because of taller, greener grass. Growth and greenness persist on these strips for a longer time than on untreated areas. If cattle have access to the pasture, the fertilized strips are more closely grazed than the untreated parts. From the hundreds of grass fertilization experiments which have been conducted, a few have been selected to illustrate how more and better feed may be produced

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through the proper use of fertilizers.

Beneficial effects of nitrogen fertilization on orchardgrass and reed canary grass fields were demonstrated by Ramage and associates at the New Jersey Dairy Research Farm at Sussex (10). Soil conditions at the farm are such that good stands of alfalfa are maintained only with difficulty. The trials were undertaken to determine whether or not soil treatments of grass meadows would aid in the production of high-protein forage to replace alfalfa. Nitrogen applications were made at rates of 50, 100, 200, and 400 lbs. to the acre. For the 200- and 400-lb. treatments, one half of the fertilizer was applied in March, the other half after the first cutting. The lighter treatments were given in one application after the first cutting. In addition to the nitrogen fertilizer, each plot received a uniform yearly application of 1,000 lbs. per acre of 0-10-10 fertilizer.

A summary of the results obtained with orchardgrass and reed canary grass is given in Table I and Fig. 1. The first harvest was usually made between May 10 and 15. The second harvest was made in June.

It will be observed from these data that the yield and protein content of the grasses increased as the rate of nitrogen application increased. Fig. 1 shows that the highest yield of hay was obtained from the first cutting and the highest protein content from the first cutting at the maximum nitrogen rate.

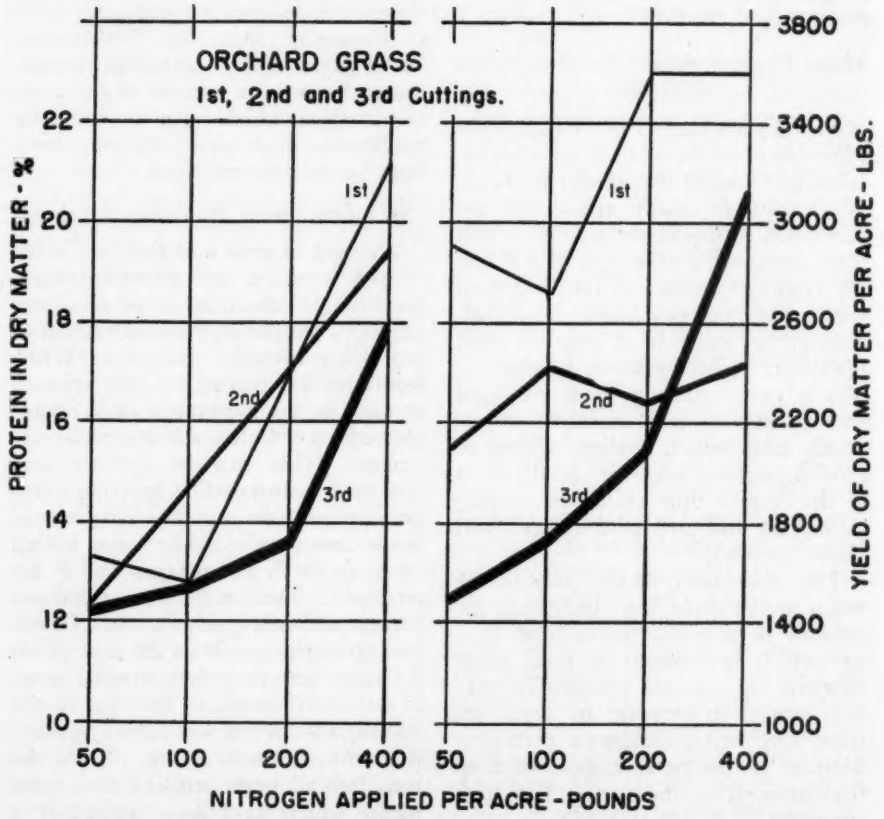

Fig. 1. Nitrogen fertilization of orchardgrass and reed canary grass meadows increased the percentage of protein in the hay as much as one half and the yields of protein to the acre to more than three times those of the unfertilized fields.

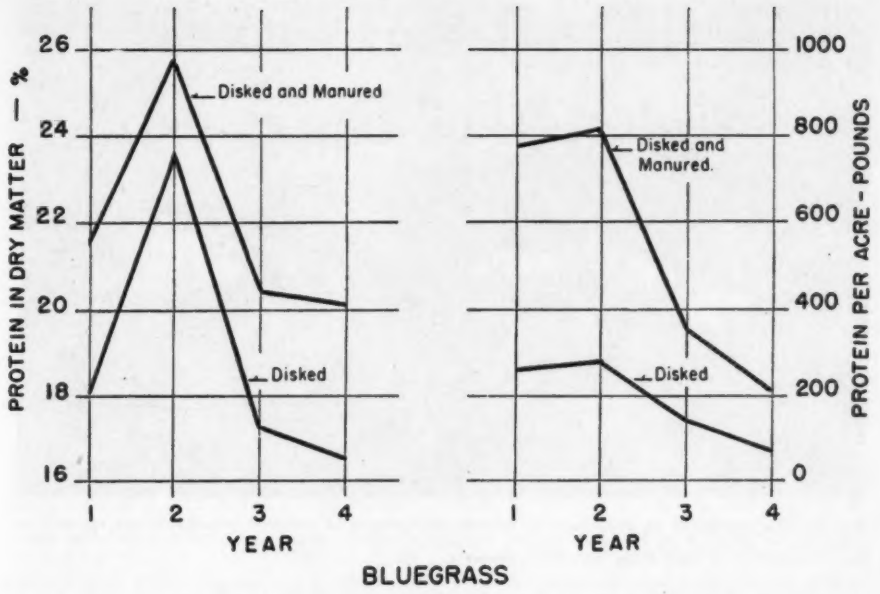

Fig. 2. The protein content of bluegrass pasture forage from fertilized plots remained much higher throughout the season than that of forage from unfertilized plots.

Therefore, it is evident from these data that nitrogen fertilization enhances the yield and protein content of grasses and thereby makes them comparable in these respects to legume hay.

The North Dakota Station conducted trials to find means for overcoming the "run-out" or "sod-bound" condition commonly ascribed to grass pastures which have become low in productivity. Tame hay and pasture yields on farms in North Dakota are reported to be about one ton to the acre. Early work at the Station had shown that cultivation or tearing up of the old sod gave only temporary relief, and application of small amounts of nitrogen was not sufficient for high yields. J. F. Carter carried out further trials in which several series of grass plots were treated with nitrogen fertilizer at higher rates of application (3).

The protein content of Lincoln bromegrass hay was increased from 8.75% to 11.55% by an application of 133 lbs. of nitrogen per acre. Hay yields rose from less than a ton to nearly three tons to the acre. The amounts of protein in the hay from the check plots and the plots most heavily fertilized with nitrogen were 118 and

TABLE I.—YIELDS AND PROTEIN CONTENT OF ORCHARDGRASS AND REED CANARY GRASS RESULTING FROM DIFFERENT RATES OF NITROGEN FERTILIZATION, 1954.

Nitrogen applied per acre lb.	Yield of dry matter per acre lb.	Protein in dry matter %	Yield of protein per acre lb.
	Orchardgrass		
50	4,238	12.18	516
100	5,742	13.57	779
200	6,957	15.78	1,098
400	8,912	20.13	1,794
	Reed canary grass		
50	3,932	13.76	541
100	5,184	15.88	823
200	7,041	16.12	1,135
400	9,381	19.42	1,822

Ramage, C. H., et al. High protein grass by fertilization. Paper presented before Eastern Division of American Dairy Science Association, Sept., 1955.

Fig. 3. The treatment of pastures with liberal applications of fertilizer usually brings spectacular responses in renewed or increased growth and also produces forage higher in feeding value (protein content) than that from untreated pastures.

653 lbs. per acre, respectively. Similarly, crested wheatgrass grown under the same kind of treatments contained 9.79 and 12.40% protein and produced 98 and 484 lbs. of protein per acre, respectively. Further, on fields treated in the same manner, green stipagrass had protein contents of 9.37 and 12.56% and produced 167 and 651 lbs. of protein an acre, respectively. Heavy application of nitrogen fertilizer is recommended for maximum forage yield and high protein content of forage.

TABLE II.—EFFECT OF URINE FERTILIZATION OF BLUEGRASS PASTURE ON COMPOSITION OF THE HERBAGE

Rate of fertilizer application	Date of sampling	Dry matter content, %	Protein in dry matter, %
None.....	Apr. 29	26.7	19.6
Heavy.....	Apr. 29	24.4	28.8
None.....	May 26	36.4	9.9
Heavy.....	May 26	32.9	17.0
None.....	June 17	47.0	8.3
Heavy.....	June 17	36.8	17.1
None.....	July 16	50.8	7.5
Heavy.....	July 16	39.0	14.3
None.....	Aug. 19	52.7	8.5
Heavy.....	Aug. 19	36.2	16.6
None.....	Sept. 15	40.0	13.1
Heavy.....	Sept. 15	25.8	26.8

(Ill. Agr. Exp. Sta., Bul 505).

The beneficial effect of barnyard manure as a fertilizer for bluegrass pastures was demonstrated by W. J. Fraser at the Illinois Experiment Station (8). Double-disking in early spring increased the yield of dry matter but did not significantly change the total amount of protein. On the other hand, the application of barnyard manure at the rate of 20 to 23 tons to the acre more than doubled the yearly yield of dry matter, increased the percentage of protein in the dry matter by one sixth, and nearly trebled the total amount of protein (Fig. 2). The low yield during the fourth year is explained by a rainfall of 5.2 inches from May through August compared with a normal rainfall of 14 inches.

The marked effect of cows' urine on bluegrass pastures was shown in further experiments at the Illinois Station (9). The urine contained approximately 1% nitrogen and 1% potassium. Table II shows the composition of grass from the untreated pasture and from the plot which received applications of

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Missouri Field Days Show Experimental Soil Treatments

By O. T. Coleman

Soils Department, University of Missouri, Columbia, Missouri

VISITORS to Experimental Field Days held this past summer at the University of Missouri saw good stands of clean alfalfa that in spite of dry weather had been producing a good four tons per acre annually on a clay-pan soil the past five years. Best results were shown to be where soil treatments were made according to soil tests and where the needed lime, phosphate, and potash were plowed down in the soil rather than just disked or harrowed into the surface. The value of annual phosphate and potash applications to meet the needs of this high value crop was also seen.

It was shown that where one has a sizeable acreage of tillable land, he might grow alfalfa in rotation. The experiment seen was a six-year rotation of corn, wheat, and four years of alfalfa but the length of the rotation and the years of alfalfa might be varied to suit the farm and its operation. Soil treatments had been applied in this experiment according to soil test recommendations, and best results were received where the alfalfa was seeded

Fig. 1. Potash made the difference—(left) fertilized with phosphate and potash; (right) fertilized with phosphate only.

on a firm seedbed about the middle of August following wheat harvest. Highest yields were received on the plots that had been in alfalfa three or four years, but it was mentioned that the yields the first year might be increased by using heavier nitrogen application at seeding time, or shortly after.

Those present also saw some liquid fertilizer spreading equipment designed to save labor in the application of fertilizers. Although mixed fertilizers applied in liquid form cost slightly more per pound of plant food than when applied in other forms, the labor of handling and applying them in liquid form was found to be less.

Improving Soil Texture

It was shown that by using sufficient nitrogen, large amounts of carbonaceous materials, such as straw, cornstalks, and sawdust, could be added to soils without reducing yields the first year, and would cause significant increases over a period of years. The mixing of such material in shallow or eroded soil helped deepen it, making it more friable, improving its texture and workability, and reducing the power needed for tillage operations. For each ton of sawdust added to the soil, it was shown an application of around 35 to 40 pounds of nitrogen was necessary to prevent nitrogen deficiencies in crops grown the first year, while for cornstalks and straw 25 to 30 pounds seemed to be enough.

Oats planted on plots where corn failed in 1954 and 1955 because of dry weather showed that fertilizer applications on drought stricken crops the past few years have not been wasted. Residual effects of nitrogen applications have often more than paid for the original cost of the fertilizer used. One of the plots shown that had received 300 pounds of nitrogen on the corn in 1954 had growing on it oats that looked like they would make 100 bushels an acre, while a plot that had only a 100-pound application at the same time probably would not yield over 30 bushels per acre.

In testing the effects of nitrogen as a supplement to legumes in a three-year rotation of corn, wheat, and legumes, it was shown that but little residual carryover can be expected from low rates of nitrogen. The old system of rotation, depending on legumes to furnish all the nitrogen, has given low yields of corn, and the wheat yields must be below maximum if clovers are to be established successfully. These results indicated that instead one should grow good corn and good wheat without trying to establish clover in the wheat; then on another area grow legumes like alfalfa as needed.

In an experiment where corn had been grown continuously since 1948, the highest average yield, 77 bushels per acre, was received where 150 pounds of nitrogen were applied in addition to applications of lime, phosphate, and potash according to soil tests, and where there were 16,000 to 18,000 stalks per acre. The next best average yield, 68 bushels per acre, was where the same soil treatments were applied but where there were only 10,000 to 12,000 stalks; while the lowest average yield, 48 bushels per acre, was on the plot where no nitrogen was applied and where there were 10,000 to 12,000 stalks per acre.

Experiments with grass showed one usually wastes his time, labor, and soil where he seeds it without proper soil treatment. From the standpoint of seed production alone, the average increase in seed yield of from 150 pounds without soil treatments to 400 pounds per acre where soil treatments are applied according to soil test recommendations usually takes care of the treatment costs. Those present also saw the important part nitrogen plays in increasing production and maintaining the desired balance between grasses and legumes. Fertilization of our pasture usually means increased yields and helps in determining the kinds of

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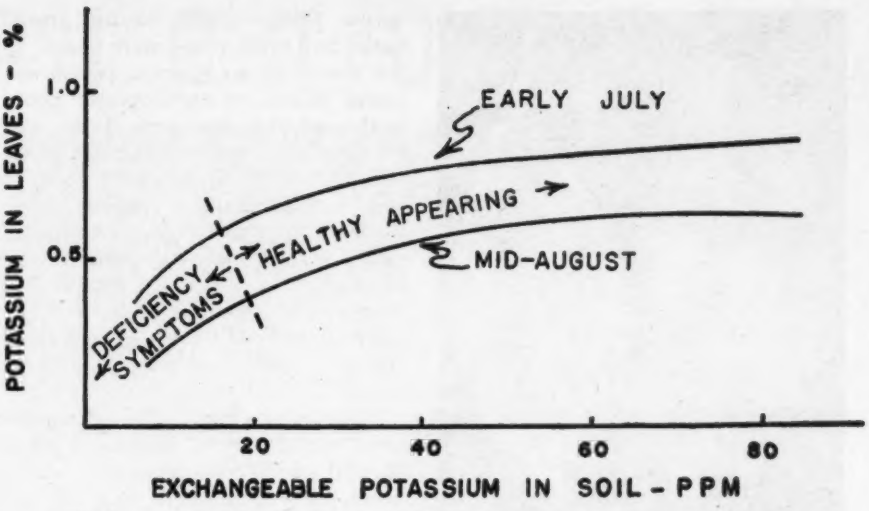


Fig. 1. Exchangeable potassium in the soil plow horizon and in leaves of white pine.

Leaf Analysis

A Potential Forestry Tool

By Laurence C. Walker

School of Forestry, University of Georgia, Athens, Georgia

ON several occasions, the pages of *Better Crops With Plant Food* have recorded the story of potash-deficient forest soils in the Adirondack Mountains of New York.[1] Another chapter to that narrative may now be written, but first, a few words of review.

Deep sands occur rather extensively in the Adirondacks. These level "sand plains," as they are locally called, were formed from deposits of coarse material left by receding glaciers in prehistoric lakes. As the lakes were drained by nature, forests of spruce, pine, and hemlock followed. Favorable topography led to farm cultivation of the plains; and then, about the turn of the century, the fields were abandoned as submarginal. Natural fertility had been depleted. Many of the sand plains were planted to pines and spruces during the 1930's. It was in these plantations that potash deficiencies were later noted.

Several years ago Dr. D. P. White—who along with Professor S. O. Heiberg of the College of Forestry at Syracuse first reported the potash deficiency—had a hunch that chemical leaf analysis of native vegetation might be useful as a tool for selecting tree species for planting on the sand plains. Unless one was willing to fertilize, it was obvious that

[1] Potash deficiency of reforested pine and spruce stands in northern New York by S. O. Heiberg and D. P. White, Dec. 1952; White birch helps restore potash-deficient soils, L. C. Walker, Dec. 1953; and Low-potash soils in Adirondack Forests, by L. C. Walker, Feb. 1956.

Fig. 2. Abnormal coloration (red) at margins of potassium-deficient wild black cherry leaf (right) and normal leaf (left).

red and white pines and red and Norway spruces could not be used on these adverse sites. On the other hand, scotch and jack pines grow fairly well on low-potash soils.

Chemical Analysis

Could laboratory tests of leaves tell us in what soils to plant scotch pine and where not to plant white spruce? Could potash-deficient abandoned agricultural land be so readily recognized?

To learn the answer, thousands of samples of leaves of many species of native plants—trees, shrubs, grasses, herbs, and even moss—were tested. In the leaves of six species, potash was found related to exchangeable potash in the soil plow horizons. From these relationships it seems reasonable to suspect that a relatively sound index of site potential may be obtained simply by analyzing the foliage. Even though rather refined analytical methods must be used, this is still much cheaper than testing soils. Readers of *Better Crops With Plant Food* have long been familiar with foliar analysis techniques in agronomic and horticultural crops.

TABLE I.—POTASSIUM IN FOLIAGE OF PLANTS (PER CENT)

Species	Unfertilized	Fertilized
	Relation to soil K shown	
Andropogon gerardi	0.42–1.53	1.42–1.90
Fagus grandifolia	0.45–1.00	.....
Fragaria virginiana	0.59–1.12	0.98–1.88
Pinus strobus	0.19–0.59	0.41–0.76
Populus tremuloides	0.20–1.20	1.01–1.29
Prunus virginiana	0.49–1.42	1.05–1.10

White pine (*Pinus strobus*) was the most useful species found. Analyses showed a high consistency between soil and leaf potash for both early July and late August leaf sampling. Also of special interest was the consistently lower amount of potash in needles as the growing season progressed. Needles collected in July from trees on low-potash sites had less than 0.6% potash. In August, potash in deficient tree needles was less than 0.4%. These relationships are illustrated in Figure 1.

Choke cherry (*Prunus serotina*) leaves likewise showed both a potash relationship with plow zone and a reduction in this nutrient from July to August. Foliage containing less than 0.6% potash is indicative of a poor site.

For American beech (*Fagus grandifolia*), trembling aspen (*Populus tremuloides*), bunchgrass (*Andropogon gerardi*), and wild strawberry (*Fragaria virginiana*), the relation to soil exchangeable potash appeared irrespective of sampling time. With these species, average leaf potash content increased as the exchangeable soil potash increased. Plots fertilized with 200 pounds per acre of KCl in the spring were also sampled for comparison and to substantiate the relationships obtained (Table I).

When exchangeable potash concentrations in plow zones are less than 20 ppm, deficient-appearing white pines

(*Turn to page* 42)

PICTORIAL

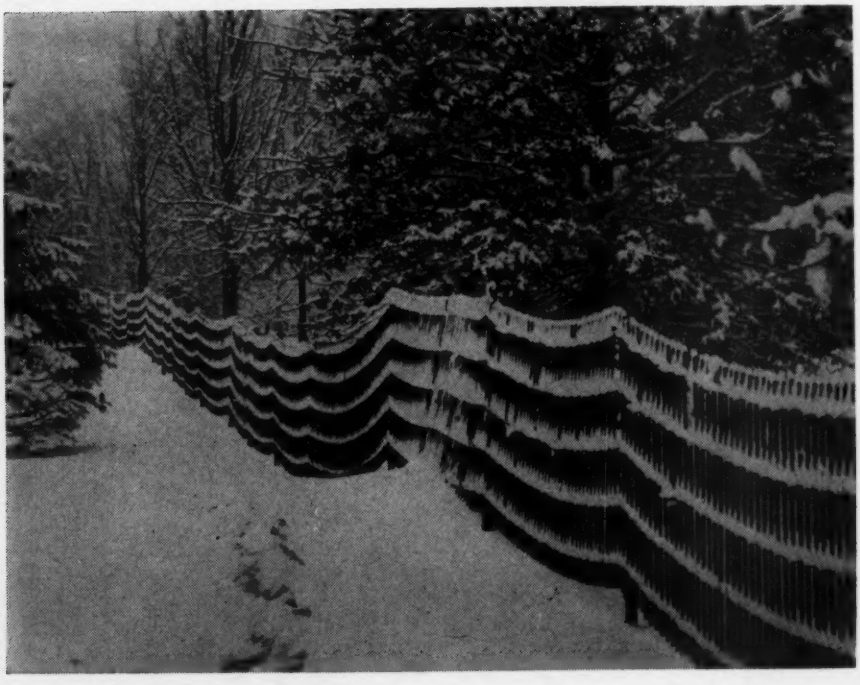
When Winter Starts

Yields High!

Quality

Good!

A Study in Fences



The Editors Talk

Our Cover Picture

The old adage—"You reap what you sow"—is not literally true when alfalfa is grown under unfavorable conditions. But when alfalfa or other legumes fail to produce as expected because of neglect of fertility conditions, then the old saying is true under the broader interpretation as originally intended. If one neglects to "sow" needed limestone or fertilizers to support the young seedlings from the time of emergence and to help them maintain vigor through their constant fight for life, one may expect early death of these plants.

An alfalfa plant cannot move about, but must live in one spot for life. It can forage for nutrients only so far, and it often runs into obstacles and competition. Foraging of the roots may be limited by compacted or acid subsoils, by too much or too little water. Any condition which restricts root growth even temporarily increases the need for higher fertility levels within the plowed layer of soil, or the roots and the tops will remain restricted by plain starvation.

The cover page illustrates the effect of the available potassium supply on the proportion of alfalfa to grasses and weeds on two plots, with and without additional potassium, at the Greenville Experiment Field, Greenville, Kentucky. For details of this experiment see the story "Fertilizing Alfalfa in Kentucky" by E. C. Doll and H. F. Miller appearing in this issue. The species separation studies were made in the third crop year.

On the low-potash plots in this experiment, many alfalfa plants were so depleted by three hay cuttings the first year that many died or were very weak to begin the second hay year. As the alfalfa became weaker, volunteer grasses and weeds had a better chance to compete.

Constant cutting of three crops of hay per year naturally drains minerals rapidly from the soil around the roots. If soil does not release enough potassium quickly, then the alfalfa may be temporarily or continually starved for this plant food. Soil tests or tissue tests can be used to check on available nutrient supplies. Then one can plan so as to prevent even the temporary or unseen deficiencies.

The Blind Spot

Aptly calling it "the blind spot," a Missouri agricultural economist believes that a farmer's failure to understand and take advantage of the profitable use of fertilizer is poor management. Gordon B. Nance, Extension Professor of Agricultural Economics at the University of Missouri, says fertilizer use could increase 6 to 10 times above present levels if farmers used plant food the same as businessmen use other factors of production to increase their profits. He points out that other businesses use money or credit to increase their earnings, particularly where the investment will return more than it costs.

To illustrate the extent to which fertilizer use can increase a farmer's net earnings, Missouri tests were cited. These tests indicated that the first $6 worth of fertilizer per acre returned 291% on below-average land planted to corn. The corn was priced at $1.20 a bushel. The second $6 gave 277%, and researchers used $40 worth of fertilizer per acre before the return from the last application declined to 5%.

When it is considered that a savings deposit returns around 3% interest and that investors are glad to get 6 to 10% even on speculative investments, the return on a farmer's investment in plant food is fantastic. When farmers realize the returns they can get from fertilizer properly used, it is difficult to see how they can keep from using all that is profitable, or all that their capital will permit. If a farmer lacks ready capital, he certainly has an attractive potential return on his investment when he approaches his banker for credit.

It may be felt that these high returns are highly speculative. It is true that they may be influenced to some extent by factors over which the farmer has little or no control, such as weather, but modern soil-testing laboratories and other diagnostic techniques for determining the fertilizer requirements of soils and crops greatly reduce the speculative aspects of investment in fertilizer. In fact, fertilizer helps to insure the return on other investments in producing a crop, such as seed, labor, pest control, taxes, and other expenses.

Professor Nance says that sooner or later the present "blind spot" in regard to fertilizer will disappear and farmers will use plant food the same as businessmen use other factors of production.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	28.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.7	91.7	173.0	153.0	200.0	16.70	86.50	....
1951.....	37.9	51.1	163.0	304.0	166.0	211.0	19.50	69.30	....
1952.....	34.6	49.9	198.0	338.0	153.0	209.0	19.95	69.60	....
1953.....	32.3	52.2	78.1	244.0	148.0	204.0	17.45	52.60	....
1954.....	33.6	51.4	123.0	216.0	143.0	214.0	17.35	60.30	....
1955									
October.....	32.83	55.0	72.3	144.0	114.0	194.0	15.75	43.50	....
November...	32.42	52.5	82.9	168.0	109.0	194.0	16.05	44.30	....
December....	31.19	57.2	80.7	203.0	115.0	195.0	16.55	45.00	....
1956									
January.....	30.67	51.3	99.4	199.0	116.0	195.0	16.55	45.50	....
February....	31.00	35.4	114.0	198.0	118.0	195.0	16.45	46.20	....
March.....	31.64	....	134.0	209.0	120.0	197.0	16.15	46.80	....
April.....	32.50	....	172.0	217.0	132.0	203.0	16.25	46.90	....
May.....	31.96	54.0	219.0	231.0	139.0	200.0	16.15	47.30	....
June.....	32.29	51.0	265.2	290.5	142.0	193.0	15.05	47.40	....
July.....	32.36	48.0	311.4	348.7	143.0	190.0	14.85	49.00	....
August.....	31.13	50.1	140.0	217.8	145.0	193.0	15.25	51.00	....
September...	32.50	53.4	100.0	191.0	143.0	195.0	15.95	47.60	....
October.....	31.94	53.0	80.4	194.0	119.0	198.0	16.75	54.10	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1930.....	77	128	131	123	93	76	93	98	128
1931.....	46	82	66	83	50	44	73	40	107
1932.....	52	105	55	62	50	43	52	46	100
1933.....	82	130	118	79	81	84	68	57	90
1934.....	100	213	64	91	127	96	111	146	94
1935.....	90	184	85	80	102	94	63	135	116
1936.....	100	236	164	106	163	116	94	148	108
1937.....	68	204	76	89	81	109	74	87	114
1938.....	69	196	80	79	76	64	57	97	96
1939.....	73	154	100	84	88	78	67	94	98
1940.....	80	160	78	97	96	77	64	96	122
1941.....	137	264	116	105	117	107	82	211	138
1942.....	153	369	168	134	143	124	91	202	178
1943.....	160	405	188	235	174	154	125	231	270
1944.....	167	420	214	216	170	160	139	234	236
1945.....	181	366	205	232	198	170	127	227	240
1946.....	263	382	178	248	212	209	141	319	217
1947.....	257	380	232	248	336	259	148	381	262
1948.....	245	482	222	253	201	226	155	298	253
1949.....	231	459	184	244	193	213	139	192	232
1950.....	323	517	132	197	238	226	141	384	211
1951.....	306	512	233	346	259	239	164	307	269
1952.....	279	499	284	385	238	236	168	309	274
1953.....	260	522	112	278	231	231	147	233	240
1954.....	270	514	176	246	223	242	146	267	228
1955									
October.....	265	550	104	164	178	219	133	193	223
November...	261	525	119	191	170	219	135	196	231
December....	252	572	118	231	179	221	139	200	231
1956									
January.....	247	513	143	227	181	221	139	202	244
February....	250	354	164	226	184	221	139	205	244
March.....	255	...	192	238	187	223	136	208	214
April.....	262	....	247	247	206	230	137	208	202
May.....	258	540	314	263	217	226	136	210	239
June.....	260	510	389	331	221	218	127	210	345
July.....	261	480	455	397	223	215	125	217	351
August.....	251	501	201	248	226	218	128	226	230
September...	262	534	143	218	223	221	134	211	243
October.....	258	530	115	221	185	224	141	240	252

Wholesale Prices of Phosphates and Potash * *

	Superphosphate, Baltimore, per unit	Florida land, pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports [1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports [1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports [1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports [1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951	.813	3.98	5.47	.401	.780	15.25	.200
1952	.849	3.98	5.47	.401	.793	15.25	.200
1953	.878	....	....	.410	.793	15.25	.200
1954	.895	....	....	.405	.791	15.27	.200
1955							
October	.895	....	....	.380	.735	14.00	.193
November	.895	....	....	.380	.735	14.00	.193
December	.895	....	....	.380	.735	14.00	.193
1956							
January	.895	....	....	.380	.735	14.00	.193
February	.895	....	....	.380	.735	14.00	.193
March	.895	....	....	.380	.735	14.00	.193
April	.895	....	....	.380	.735	14.00	.193
May	.895	....	....	.380	.735	14.00	.193
June	.895	....	....	.360	.720	13.45	.177
July	.895	....	....	.380	.735	14.00	.177
August	.895	....	....	.380	.735	14.00	.177
September	.895	....	....	.380	.735	14.00	.177
October	.895	....	....	.380	.735	14.00	.177
			Index Numbers (1910-14 = 100)				
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951	152	110	112	72	82	63	83
1952	158	110	112	72	83	63	83
1953	164	...	...	73	83	63	83
1954	167	...	...	72	83	63	83
1955							
October	167	...	...	69	77	58	82
November	167	...	...	69	77	58	82
December	167	...	...	69	77	58	82
1956							
January	167	...	...	69	77	58	82
February	167	...	...	69	77	58	82
March	167	...	...	69	77	58	82
April	167	...	...	69	77	58	82
May	167	...	...	69	77	58	82
June	167	...	...	66	76	56	80
July	167	...	...	69	77	58	80
August	167	...	...	69	77	58	80
September	167	...	...	69	77	58	80
October	167	...	...	69	77	58	80

Wholesale Prices of Ammoniates * *

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish, scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.36
1951	3.16	1.97	13.20	10.92	10.18	10.09
1952	3.34	2.09	13.95	11.27	9.72	9.16
1953	3.26	2.27	11.04	11.19	7.39	7.09
1954	3.07	2.20	11.50	11.63	9.72	9.85
1955						
October	2.98	2.07	9.17	13.01	7.47	7.16
November	2.98	2.07	8.71	13.10	6.14	6.23
December	2.98	2.12	9.21	12.93	5.66	6.00
1956						
January	2.98	2.12	9.43	12.75	5.58	5.58
February	2.98	2.12	8.69	12.15	5.77	5.69
March	2.98	2.12	8.30	11.89	5.92	5.92
April	2.98	2.12	8.31	11.66	5.77	5.71
May	2.98	1.70	8.67	11.80	6.60	6.37
June	2.98	1.56	8.72	11.29	6.37	6.23
July	2.98	1.56	9.37	10.89	6.80	6.37
August	2.98	1.56	9.99	11.26	6.53	6.37
September	2.98	1.56	9.10	11.28	6.68	6.68
October	2.90	1.56	9.11	11.35	7.53	6.86
Index Numbers (1910-14 = 100)						
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951	118	69	377	310	302	287
1952	125	74	399	319	288	260
1953	122	80	315	317	219	201
1954	114	77	329	330	288	280
1955						
October	111	73	262	369	222	203
November	111	73	249	371	182	177
December	111	74	263	366	168	170
1956						
January	111	74	269	361	166	159
February	111	74	248	344	171	162
March	111	74	237	337	176	168
April	111	74	237	330	171	162
May	111	60	248	334	196	181
June	111	55	249	320	189	177
July	111	55	268	308	202	181
August	111	55	285	319	194	181
September	111	55	260	320	198	190
October	108	55	260	322	223	195

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1930.....	125	140	126	105	72	131	101	99
1931.....	87	119	107	83	62	83	90	99
1932.....	65	102	95	71	46	48	85	99
1933.....	70	104	96	70	45	71	81	95
1934.....	90	118	109	72	47	90	91	72
1935.....	109	123	117	70	45	97	92	63
1936.....	114	123	118	73	47	107	89	69
1937.....	122	130	126	81	50	129	95	75
1938.....	97	122	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	130	127	86	56	130	120	77
1942.....	159	149	144	93	57	161	112	77
1943.....	193	165	151	94	57	160	117	77
1944.....	197	174	152	96	57	174	120	76
1945.....	207	180	154	97	57	175	121	76
1946.....	236	197	177	107	62	240	125	75
1947.....	276	231	222	130	74	362	139	72
1948.....	287	250	241	134	89	314	143	70
1949.....	250	240	226	137	99	319	144	70
1950.....	258	246	232	132	89	314	142	72
1951.....	302	271	258	139	93	331	152	76
1952.....	288	273	251	144	98	333	158	76
1953.....	258	262	247	139	100	269	164	77
1954.....	249	264	248	142	95	311	167	76
1955								
October...	230	261	250	134	91	259	167	72
November.	225	259	250	131	91	235	167	72
December..	223	259	250	131	92	232	167	72
1956								
January...	226	259	252	131	92	232	167	72
February..	226	259	252	130	92	225	167	72
March....	228	261	254	130	92	222	167	72
April.....	235	261	257	130	92	219	167	72
May.....	242	264	257	128	85	236	167	72
June.....	247	264	257	126	82	231	167	70
July.....	244	266	257	128	82	242	167	72
August....	237	267	259	128	82	246	167	72
September.	236	266	259	128	82	239	167	72
October...	234	265	259	128	81	252	167	72

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] Potash salts quoted F.O.B. mines; manure salts since June 1941; other carriers since June 1947.

** Where range of prices for fertilizer material is quoted, average figure is used. The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Care and Use of Poultry Manure," Agr. Exp. Sta., Univ. of Conn., Storrs, Conn., PR 12, Jan. 1956, S. Papanos and B. A. Brown.

"Fertilizer Recommendations for Georgia," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Cir. 371, Rev. May 1956.

"Fertilizer Use for Efficient Crop Production," Agr. Ext. Serv., Iowa State College, Ames, Iowa, Pamph. 227, July 1956, J. A. Stritzel.

"Guide to Fertilizer Use for the Clarion-Webster Soil Association Area," Agr. Ext. Serv., Iowa State College, Ames, Iowa, Pamph. 228-1, Aug. 1956, J. A. Stritzel.

"Analyses of Official Fertilizer Samples by the Feed and Fertilizer Department, Kentucky Agricultural Experiment Station, Semi-Annual Report, Spring Season, January-June, 1956," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Reg. Bul. 133, Oct. 1956.

"Phosphate Fertilizers, Kinds and Relative Values," Agr. Ext. Serv., Univ. of Ky., Lexington, Ky., Lflt. 114, Rev. June 1955, P. E. Karraker and J. F. Freeman.

"1956 Cranberry Fertilizer Chart," Agr. Exp. Sta., Univ. of Mass., Amherst, Mass., 1st Chart.

"Fertilizer Trials on Alfalfa, Cotton, and Sorghum in New Mexico," Agr. Exp. Sta., N. Mex. A. & M. College, State College, N. Mex., Bul. 408, June 1956, R. W. Leamer.

"Boron in the Fertilization of Flue-Cured Tobacco," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Tech. Bul. 120, March 1956, T. B. Hutcheson, Jr., and W. G. Woltz.

"1957 Fertilizer Recommendations," Agr. Ext. Serv., N. C. State College, Raleigh, N. C., Lflt. 3, Oct. 1956.

"Commercial Feeds, Commercial Fertilizers, Economic Poisons, 1955 Report," State Lab. Dept., Bismarck, N. Dak., Bul. 112, May 1956.

"Tonnage Distribution of Fertilizer in Oklahoma Counties by Grades and Material for the Period July 1, 1956 to October 1, 1956," State Dept. of Agr., Oklahoma City, Okla.

"Fertilizer Report for the Year 1955," State Dept. of Agr., Harrisburg, Pa., Gen. Bul. 664, Vol. 39, No. 1, Jan.-Feb. 1956.

"Fertility Trials on Winter Oats at Denton, 1956," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, Prog. Rpt. 1894, Oct. 1956, P. A. Rich and D. I. Dudley.

Soils

"Effect of Soil Management Practices Upon Soil and Leaf Analyses in a Peach Orchard," Agr. Exp. Sta., Univ. of Del., Newark, Del., Tech. Bul. 316, June 1956, C. W. Hitz, G. M. Gilligan, and H. Amling.

"Subsoiling Results at the Delta Station in 1955," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sh. 535, April 1956, P. Grissom, E. B. Williamson, O. B. Wooten, F. Fulgham, and W. A. Raney.

"Soils of Sweet Grass County, Soil Reconnaissance of Montana, Preliminary Report," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 519, May 1956, L. F. Gieseker.

"An Inventory of Ohio Soils, Carryall, Crane, Paulding, and Jackson Townships, Paulding County, Ohio," Dept. of Natural Resources, 553 E. Broad St., Columbus, Ohio, Prog. Rpt. 5, 1955.

"An Inventory of Ohio Soils, Union, Chester, Adams Townships, Clinton County, Ohio," Dept. of Natural Resources, 553 E. Broad St., Columbus, Ohio, Prog. Rpt. 6, 1956.

"Growing Ornamental Greenhouse Crops in Gravel Culture," Agr. Exp. Sta., Wooster, Ohio, Spec. Cir. 92, Sept. 1956, D. C. Kiplinger.

"The Relation of Subsoiling, Deep Lime and Deep Phosphate Application to the Yields of Corn, Peanuts, and Alfalfa in Virginia," Agr. Exp. Sta., Va. Polytechnic Institute, Blacksburg, Va., Res. Rpt. 1, March 1956, R. K. Stivers, J. H. Lillard, G. D. Jones, and A. H. Allison.

"We Can All Help Save Our Soils," Agr. Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 360, Rev. May 1956, O. R. Zeasman and J. W. Clark.

Crops

"Cool Season Grazing and Feed Crops," Agr. Ext. Serv., Ala. Polytechnic Institute, Auburn, Ala., Cir. 480, Aug. 1955, J. C. Lowery, O. N. Andrews, and R. Jones.

"Best Silage Crops for Alabama," Agr. Ext.

Serv., Ala. Polytechnic Institute, Auburn, Ala., Cir. 491, April 1956, J. C. Lowery and O. N. Andrews.

"Small Grain Experiments, 1956," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series 48, July 1956, R. L. Thurman.

"Eastern Arkansas Alfalfa Variety Tests, 1955," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Mimeo. Series 49, Aug. 1956, J. F. Jacks.

"Growing Head Lettuce in Arizona," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 278, Sept. 1956, W. D. Pew, R. B. Marlatt, and L. Hopkins.

"Ontario Soil and Crop Improvement Association, 1956 Convention, Addresses and Proceedings," Dept. of Agr., Ottawa, Ont., Can.

"Alfalfa Seed Production in the Prairie Provinces," Dept. of Agr., Ottawa, Ont., Can., Pub. 984, Aug. 1956, J. L. Bolton.

"Cereal Breeding Laboratory, Winnipeg, Manitoba, Progress Report 1949-54," Exp. Farms Serv., Dept. of Agr., Ottawa, Ont., Can., July 1956.

"Experimental Farm Highlights in the Atlantic Provinces, 1955," Exp. Farms Serv., Dept. of Agr., Ottawa, Ont., Can., July 1956.

"Experimental Farm, Harrow, Ontario, Progress Report 1947-1954," Exp. Farms Serv., Dept. of Agr., Ottawa, Ont., Can., May 1956.

"Cotton Production Guide," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 143, Jan. 1956.

"Field Corn Production Guide," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 144, Jan. 1956.

"Peanut Production Guide," Agr. Ext. Serv., Univ. of Fla., Gainesville, Fla., Cir. 145, Jan. 1956.

"Earlysweet Sweetpotato Introduction," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Mimeo. Series N. S. 28, Oct. 1956, S. Harmon and O. J. Woodard.

"39th Annual Report of the Department of Agriculture for the Fiscal Year July 1, 1955—June 30, 1956," State Dept., of Agr., Springfield, Ill.

"Sweet Clover in Kansas," Agr. Ext. Serv., Kans. State College, Manhattan, Kans., Ext. Cir. 250, Rev. June 1955, E. A. Cleavinger and L. E. Willoughby.

"Lespedeza in Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Cir. 251, Rev. April 1956, K. L. Anderson.

"Quality Wheat Pays!" Agr. Ext. Serv., Kans. State College, Manhattan, Kans., Ext. Cir. 253, June 1956, N. V. Whitehair and J. H. McCoy.

"Guide to Planting Forest Trees," Agr. Ext. Serv., Univ. of Ky., Lexington, Ky., Lflt. 101, Dec. 1955, W. E. Jackson.

"Payday in May from Strawberries," Agr. Ext. Serv., Univ. of Ky., Lexington, Ky., Lflt. 145, Feb. 1955, W. W. Magill and J. K. Stacey.

"Your Burley Tobacco Crop This Year, How to Produce the Kind of Burley Tobacco That the Manufacturers Can Use," Agr. Ext. Serv., Univ. of Ky., Lexington, Ky., Lflt. 147, March 1955.

"Sudan Grass," Agr. Ext. Serv., Univ. of Ky., Lexington, Ky., Lflt. 154, June 1956, E. N. Fergus, R. C. Buckner, and W. H. Stroube.

"1955 Potato Variety Trials," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Mimeo. Rpt. 60, March 1956, C. E. Cunningham, R. V. Akeley, and R. A. Struchtemeyer.

"Tree Fruits: Their Place in the Home Garden," Agr. Ext. Serv., Univ. of Mass., Amherst, Mass., Lflt. 293, Jan. 1956, O. C. Roberts.

"Mississippi Agricultural Extension Service, Annual Report 1955," Agr. Ext. Serv., Miss. State College, State College, Miss., Pub. 330, June 1956.

"Summer Annual Crops Make Good Pastures for Milk Production," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sh. 532, April 1956, J. T. Miles, W. C. Cowsert, J. W. Lusk, and J. R. Owen.

"Small Grains, Legumes, and Grasses," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 134, Jan. 1956.

"Farm Windbreaks," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 656, Oct. 1955, L. E. McCormick.

"Grass Silage, How to Make It, Methods of Handling and Feeding Recommendations," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 665, April, 1956, J. F. Lasley, S. S. Rowe, J. R. Fleetwood, E. T. Itschner, P. R. Cornelison, and R. L. Ricketts.

"Field Crop Varieties in Montana," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Cir. 208, April 1956.

"Research Points the Way, Sixty-Sixth Annual Report of the New Mexico Agricultural Experiment Station for the Fiscal Year Ended June 30, 1955," Agr. Exp. Sta., N. Mex. A. & M. College, State College, N. Mex.

"Pasture Firebreaks, Construction and Species Trials on Pond Pine Sites in North Carolina," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Bul. 398, April 1956, W. O. Shepherd, R. H. Hughes, E. U. Dillard, and J. L. Rea.

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"Forage Crops Evaluation and Manage-

ment Studies, Progress Report, 1955," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Mimeo. Cir. M-279, May 1956, W. W. Huffine.

"67th Annual Report of the South Carolina Agricultural Experiment Station," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Dec. 1955.

"Suggestions for Producing High Quality Sweet Potatoes for Commercial Purposes," Agr. Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 411, Jan. 1956, H. A. Bowers.

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"Varieties Recommended for South Dakota in 1956," Agr. Exp. Sta., S. Dak. State College, Brookings, S. Dak., Lflt. 174, Jan. 1956.

"Agricultural Research at the Central Substation, Highmore, South Dakota, a Progress Report," Agr. Exp. Sta., S. Dak. State College, Brookings, S. Dak., Cir. 124, April 1956.

"Agricultural Research in Texas Since 1888," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, MP-177, Aug. 1956, T. Moses.

"Cotton Variety Trials in the Lower Rio Grande Valley, 1956," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, Prog. Rpt. 1895, Oct. 1956, J. L. Hubbard.

"Yield of Tomato Varieties in East Texas, 1956," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, Prog. Rpt. 1896, Oct. 1956, P. A. Young.

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"Combine Shallu, a New Variety of Shallu," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, L-304, Sept. 1956.

"White Granex, a First-Generation Hybrid Onion," Agr. Exp. Sta., Texas A. & M. College, College Station, Texas, L-307, Sept. 1956.

"Silos and Silage," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Bul. 232, Sept. 1955.

"Fruit Varieties for Virginia," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Bul. 240, June 1956, G. D. Oberle, R. C. Moore, and W. P. Judkins.

"Alfalfa Production in Virginia," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Cir. 374, July 1956.

"Winter Pastures with Cover Crops," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Cir. 505, Rev. July 1956.

"Sudan Grass or Pearl Millet for Summer Pasture," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Lflt. 1, Rev. April 1956.

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"Red Clover Production in Virginia," Agr. Ext. Serv., Va. Polytechnic Institute, Blacksburg, Va., Cir. 679, March 1956.

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"Pastures for Horses," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Stas. Cir. 289, May 1956, M. W. Galgan, W. C. Green, M. E. Ensminger, J. K. Patterson, A. G. Law, and J. L. Schwendiman.

"Wisconsin Red Raspberries," Agr. Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 515, Feb. 1956, G. C. Klingbeil.

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"Effect of Spacing on Some Agronomic and Fiber Characteristics of Irrigated Cotton," USDA, Wash., D. C., Tech. Bul. 1140, June 1956, R. H. Peebles, G. T. D. Hartog, and E. H. Pressley.

"Breeding Perennial Forage Grasses," USDA, Wash., D. C., Tech. Bul. 1145, July 1956, A. A. Hanson and H. L. Carnahan.

Economics

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"Federal Agricultural Legislation in Canada, 1955-1956 Supplement," Dept. of Agr., Ottawa, Ont., Can., 56/23, Aug. 1956.

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639, Area 8; A. Ec. 640, Areas 9, 12, 14; A. Ec. 641, Area 10; A. Ec. 642, Areas 15, 16, 17, 1956, W. H. Vincent, et al.

"Looking Ahead With Montana Farmers and Ranchers, Farm and Home Topics," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Fldr. 42, April 1956.

"Recent Trends in New Mexico Agriculture," Agr. Exp. Sta., N. Mex. A. & M. College, State College, N. Mex., Bul. 406, April 1956, P. W. Cockerill.

"Guides to Farming in the Central Plain Region, New York," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., A. E. 1035, May 1956, L. C. Cunningham.

"Costs and Returns in Producing Tomatoes for Processing 123 Farms, Western New York, 1955," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., A. E. 1025, March 1956, B. F. Stanton and D M. Stevens.

"Management Practices and Crop Yields on the Lower Yellowstone Project, 1949," Agr. Exp. Sta., S. Dak. State College, Brookings, S. Dak., Agr. Econ. Pamph. 64, Aug. 1955, R. Helfinstine.

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"Farm Population, Net Migration from the Rural-Farm Population, 1940-50," USDA, Wash., D. C., Stat. Bul. 176, June 1956, G. K. Bowles.

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"Recent Developments in Futures Trading Under the Commodity Exchange Act," USDA, Wash., D. C., Agr. Inf. Bul. 155, June 1956, R. R. Kauffman.

"Soil Bank Highlights," USDA, Wash., D. C., PA 297, Aug. 1956.

"Food Expenditures, Preservation, and Home Production by Rural Families in the North Central Region, 1951-52," USDA, Wash., D. C., Agr. Inf. Bul. 113, Aug. 1956, M. Orshansky, E. C. Blake, and M. A. Moss.

Missouri Field Days . . .

(*From page* 24)

plants (grass or legumes), that predominate and the composition or feeding value of the forage produced.

On the experiment comparing subsoil, normal soil, and double depth of surface soil, it was shown that in a rotation of corn, wheat, and clover, yields on subsoil treated according to soil tests were comparable to those received on double depth of surface soil where only starter applications of 150 pounds of 4-16-4 were used on corn and wheat. Actually the five-year average for corn was about two bushels more for the double depth surface soil plus the starter fertilizer, while for wheat it was about two bushels more on the subsoil plots where full treatment according to soil tests was applied than where seeded on double depth of surface soil where only the starter fertilizer was used. An important point that was mentioned in connection with this experiment, however, was that the full treatments would have been less for the double depth of surface soil, and the average yields would have no doubt been higher if they had been applied to the plots having the deeper surface soil.

In fact, to get the most for the money you invest in soil treatments, it was emphasized that soil tests be made on all fields, and those requiring the least treatment be treated first. Then the added income from those fields requiring least investment in soil treatments could be used for the purchase of the needed lime and fertilizer for those fields requiring the heavier treatments,

which might give slightly less return per dollar invested in soil treatments but which would still pay a good return on the money invested in these treatments.

On the combine wheat plots, where wheat has been grown continuously since 1939, it was shown that for the last five years the highest yield was where 200 pounds of 0-20-20 fertilizer were applied at seeding time, an extra ton of straw in addition to the regular combined straw was added, and 33 pounds of nitrogen turned under with it, plus 33 pounds topdressed on this same plot in the spring. But for the first five years, the highest yields were where the straw had been burned off each year and 66 pounds nitrogen, in addition to the 200 pounds of 0-20-20 starter fertilizer, applied with seed. The lowest average yields for the whole 16-year period was where the straw was taken off and no nitrogen added, but just the 200 pounds of 0-20-20 applied at seeding time. This experiment again emphasized the importance of maintaining an adequate turnover of organic matter in the soil for best returns from the soil treatments applied.

Roots Make a Difference

(*From page* 18)

only one of the soil and water conservation measures now in effect in the 44 farmer-organized and farmer-controlled Soil Conservation Districts in our State.

The rapid spread of grass and its acceptance by farmers have been due to the combined efforts of farm leaders, SCS, Extension Service, Vocational Agriculture teachers, and the Agricultural Conservation Program. Along with the greater respect for grass has come the knowledge that good grass requires good management. And farmers in South Carolina along with others all over America are now convinced that an uneaten blade of grass is not a wasted resource.

Fig. 3. This "Conservation Farmer" of Charleston County, South Carolina, turned under a portion of his Bahia grass and planted tomatoes. The more than 4½ tons of Bahia grass per acre proved helpful in making a high yield of tomatoes. SCS photo.

Leaf Analysis . . .

(*From page* 26)

usually result. Based upon this observation and the soil-leaf potash relationships found, the following are critical foliage values below which deficient planting sites are indicated.

Species	Leaf K–%	Sampling date
White pine.....	0.6	July
White pine.....	0.4	August
Trembling aspen...	0.7	August
Bunch grass.....	1.4	July
American beech....	0.6	July & Aug.
Choke cherry.....	0.7	July
Choke cherry.....	0.6	August
Wild strawberry....	0.9	July & Aug.

Thus, these species of native vegetation serve as indicators of site quality since normal growth of white and red pines and spruces cannot be expected in areas where potash in the soil results in leaf potassium below these levels, unless fertilizing is anticipated. Instead, scotch and jack pines—low-potash-demanding species—are recommended for planting. Further testing is needed, but it is hoped the practicing forester may someday readily apply this tool to his trade by sampling leaves in proposed reforestation areas during the summer prior to the winter planting season. And thus, laboratory tests would enable ready recognition of potash-deficient, or sufficient land.

Foliage Symptoms

Discolorations in leaves of native trees also serve to indicate soils too potash-deficient for the more desirable conifers, such as white and red pine and the spruces. From preliminary studies, this seems especially true for black cherry (*Prunus serotina*). About the middle of August, bright red leaf margins extending almost to leaf tips and one half the distance to the midrib developed. The line of demarcation between pigmentation was well defined. By late September, the colored margins had widened and extended to the leaf tip. Red color intensity also increased, and blue and violet hues were produced. Autumn coloration was distinctly different. Trees so affected occurred only on low-potash soils. When fertilized in the spring, prior to taking observations and sampling for potash content, leaves did not exhibit this symptom (Fig. 2). For the single season in which the symptom was studied, it generally appeared when leaf potash fell below 0.8% in mid-August.

Sometimes cultivated fruit trees, particularly in cherry orchards, have a similar pigmentation which horticulturists have attributed to magnesium deficiency. However, the horticulturists report that potassium fertilization of light soils often induces magnesium-deficiency symptoms. Since this did not happen in the present case, it seems most probable that the symptom is that of potash deficiency, though low levels of both elements often occur together.

Another invader of old fields which is a potential indicator is gray birch (*Betula populifolia*). Chlorosis of leaves, beginning at the margins and proceeding inward, was noted in mid-August (Fig. 3).

The transition from yellowish-white chlorotic coloration to normal-appearing green tissue in gray birch leaves exhibiting deficiency symptoms is sharp in contrast to the gradual transition of colors in autumn foliage. The critical value for leaf potash in mid-August below which this symptom appeared was 1.0%.

Browning between veins of blackberry (*Rubus spp.*) leaves shows up in midsummer. This discoloration, closely resembling the natural coloration of foliage in autumn, extends practically to the midrib. It seems to occur only

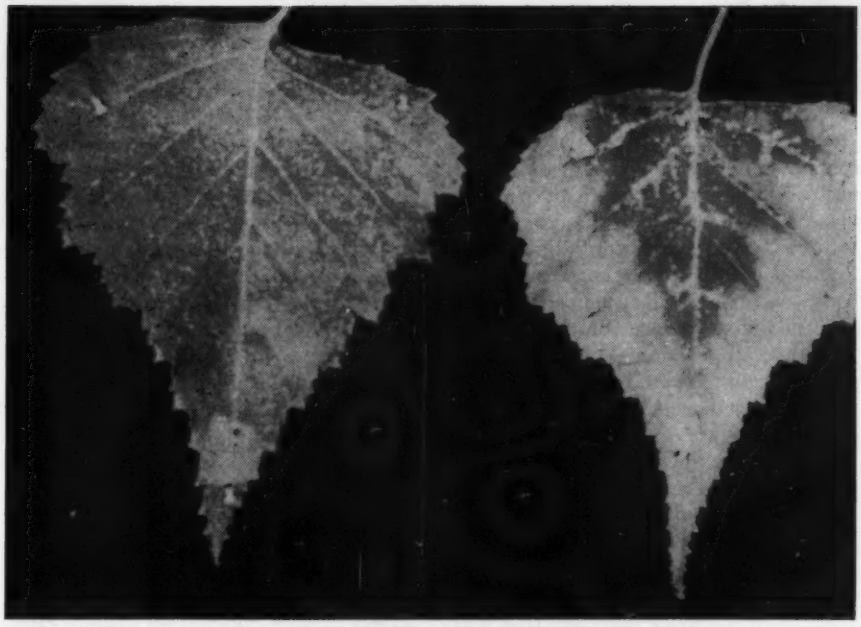

Fig. 3. Chlorotic margins of gray birch leaf (right) and normal leaf (left).

when foliar potash is less than 0.8%.

Of course the best indicator of all, where it occurs, is white pine (*Pinus strobus*). Professors Heiberg and White first noted its potash-deficiency symptoms in 1950. The needles are short and chlorotic. As the deficiency continues, they turn brown and drop off prematurely—perhaps after one growing season instead of the usual three or four. It should be noted that observations of this abnormality must be made in the spring. Elongation of new branches and needles as the season progresses tends to mask leaf symptoms.

Chemical analyses of needle tissue in July showed that white pines with deficiency symptoms contained from 0.32 to 0.59% potash and non-deficient trees from 0.53 to 0.84%. This decreased in August to between 0.19 and 0.38% for deficient and 0.40 and 0.55% for healthy trees, exclusive of fertilized individuals.

In conclusion, it should be pointed out that sites presently occupied by species with deficiency malformations have responded favorably to 200 pounds per acre of 60% muriate of potash. However, in low-potash areas, less demanding conifers such as Scotch and jack pines are recommended.

The bare-footed young man stood before the grizzled mountaineer.

"Mistuh Claghorn," he stammered, "Ah've—Ah've come hyar to ask ya for yar daughter's hand."

The mountaineer knocked the ashes out of his pipe.

"Can't allow no sech thing," he drawled, "Ither yer takes the whole gal, or nothin'!"

A man on a deck chair trying to sleep. Along comes a little kid, starts asking questions and pestering him to death.

"Run along, kid," said the man, "I'm trying to sleep."

"My daddy sleeps in bed," answered the kid.

"Yeah? Well your daddy didn't sleep long enough."

A Look at the Orient

(*From page* 16)

control is effected by the introduction, multiplication, and release of parasitic insects. Disease is controlled by breeding resistant types of cane. This brings to mind Reginald H. Painter's recent book on "Insect Resistance in Crop Plants," in which he commented that "the spectacular successes of the newer insecticides . . . have tended to obscure the fact that there are many other ways by which insects can be controlled. Information on these other ways is not broadcast by highly paid advertising staffs."

Another highly significant development in the Hawaiian Islands is the use of brackish water for irrigation purposes. The evidence indicates that such water can be used to advantage for supplemental irrigation on well-drained soils. By abundant use of such water, salts do not accumulate, and sugar cane, alfalfa, and vegetables can be grown successfully.

Intelligent and Aggressive

The Japanese are highly intelligent, active, and aggressive people. They are unable to produce enough food on their limited acreage of crop land to meet their needs. Consequently, their agricultural scientists are very energetically engaged in studies designed to add to their food supplies. Among these studies is a pilot-plant operation for the production of a high-protein supplemental food from *chlorella,* a species of algae. The estimated cost of producing a 60 per cent protein product by this means is 25 cents a pound, on a dry-weight basis. Another matter of much interest is the fully-confirmed discovery that blue-green algae make highly important contributions toward maintaining the nitrogen supply in paddy-rice soils.

Although sanitary sewers are now in operation in Japanese cities, human excreta from towns and villages is still being used for manurial purposes on a large scale. One meets many ox-pulled carts carrying odoriferous "honey buckets" from village to farm. The visitor is still well advised not to eat uncooked vegetables as such or in salad form. This applies generally throughout the Orient.

Some 4,000 students are enrolled in the College of Agriculture at Los Baños in the Philippines. This college is being assisted by a staff of agricultural scientists and technicians loaned by Cornell University. The primary task of the Cornell specialists is to work themselves out of a job by close association with their counterparts on the Philippine college and station staffs. Similar educational assists are being given by a number of other American agricultural colleges in various other parts of Asia.

Research Under Way

In India, production of dried cow manure for fuel is big business, some 200 million tons of cattle manure being sold for this purpose annually. One sees women sitting by the roadside making the moist manure into artistic patties with their hands. These are plastered on walls to dry out and are then stacked in large heaps that are covered over with clay. Research is under way to develop cumbustible gases from dung and other wastes, keeping the spent residue for return to the soil. There appears to be important possibilities in such processes in rural areas. Gas-producing units of this type are now in operation not only in India but in European and North African countries as well.

All Arabian countries, including North Africa, and all southern European countries from Greece to Portugal are overrun with mixed flocks of sheep and goats. Pastures are grazed so con-

sistently and closely that virtually no cover remains. Goats are particularly destructive of all kinds of vegetation. Shrubs and young trees never get a chance. I think it fair to raise the question as to which came first—the goat or the desert. Certainly the goat has added materially to the size of the desert areas.

Donkeys, oxen, camels, elephants, men, and women bear the burdens in the Asiatic and Mediterranean countries. Motorized machinery is relatively limited. Improvement in this situation depends largely on the development of an industrial economy by which surplus labor is drained off the farm and used effectively in the production of more consumer goods that are badly wanted and needed by the people of these countries. Such changes will undoubtedly be very slow. It has taken centuries for these people to get as deeply involved as they are with their present thinking and economy. And it is quite likely to require centuries to escape from them.

Impressed With U. S.

On return to the United States I am more impressed than ever about the widespread prosperity of this country. We not only enjoy the greatest abundance of the finest foods but we have a vast array of luxuries at our disposal. I have the impression, however, that our thinking about all these matters is quite superficial. Everything comes easy, so why worry? Our population is growing rapidly, but we still have surpluses. Our whole economy is built on rapid growth in population and ever-growing demand for everything from teething rings to tombstones.

But I think it is high time that serious thought be given to the question of how many people we can afford in this country. The 2,500 million people of the entire world are growing at the rate of 25 million, or 1 per cent a year. But our population is increasing at the rate of 2.8 million, or 1.65 per cent a year. The current estimate is for something over 200 million people in continental United States by 1975 and over 300 million by the year 2000.

A recent issue of *Harvard Business Review* carried an article by Joseph J. Spengler on "Population Threatens Prosperity." He writes:

"Americans today, living much better than they ever have before, will feel the pinch of scarcity which went unnoticed until everybody began to want more and demand more. Shortages which are being brought to light by the course of demographic events in the United States will be greatly intensified by the progress of population and aggregate consumption in other parts of the world, since these new areas will be drawing increasingly on relatively limited resources of supply, major access to which has heretofore been enjoyed by Americans."

Merits Study

This point merits study. But I am much more impressed by Spengler's final statement. He writes:

"Of even greater importance is the fact that continuation of population growth is likely to intensify various social and economic problems, solution to which will be largely sought through state intervention. Should this come to pass, the economy would become less flexible and the freedom of individuals to do as they please would tend to be highly circumscribed. In this event the stork would have managed to do what the followers of Marx had found themselves unable to do for all they tried—fasten fetters on mankind."

Contrast this with an editorial in the January 10, 1955, issue of *Time* magazine. It read:

"Very little is known about the subtle and important relationships between population growth and economics. But enough is known to discredit Malthus. Americans can take present population figures as a promise of more prosperity. Gone, for the first time in history, is the worry whether a society can produce enough goods to take care of its people.

The lingering worry is whether it will have enough people to consume the goods."

I wrote the editors of *Time* a note. It did not impress them. I shall try it on you:

"*Time's,* January 10 'People and Plenty,' saying that U. S. population growth and economics discredit Malthus, promise more prosperity, and leave only a lingering worry whether we will have enough people to consume the goods, lends encouragement where it is least needed. Hopefully all of us can say with Herbert Hoover that 'the older I grow the more I appreciate children.' But there's a limit to our capacity to enjoy the grown-ups into which they develop. And Malthus, whose famous *Essay* started with the axiom that 'the attraction between the sexes is necessary and will continue' may in due time return to plague even us, synthetic chlorophyll urged on by atomic energy notwithstanding.

"Our imminent problem is not food —we can probably produce enough to feed one billion people well—but population pressure. How long can we continue with the yearly addition of the equivalent of one 60,000 city in every one of the 48 states without finding ourselves in each other's way? Some 1,000 million acres of our land will always have too little water—even after milking the clouds and extracting extra supplies from the sea—to support more than very sparse populations. And much of the remaining 904 million acres—some of this the most productive land we have—is being rapidly lost to cities, superhighways, factories, and reservoirs. The future looks highly exciting, but we'd better go slow about encouraging our young folks to hurry up and produce a lot more of us."

And this applies to encouraging immigration as well. Most of us are immigrants or descendants from them. Naturally a lot of foreign people, many of them in dire straits, would like to come to this land that is "flowing with milk and honey." But if the welfare of our descendants means anything to us, we had better begin now with an educational program that is designed to bring population growth under control. That, to me, is *the* lesson of the Orient.

Weeds—Robbers of Our Farms

(*From page* 12)

ference in potassium content between corn grown alone and corn grown with weeds was significant. Also, strong competition was clearly evident for nitrogen, especially in early stages of growth. This occurred notwithstanding the fact that all plots were liberally fertilized with all essential plant nutrients. Apparently, even at these high rates of fertilization, weeds competed strongly with corn for all essential plant nutrients, as well as for light and moisture. When comparing the chemical composition at the same stage of growth of corn and weeds grown together, we see that common corn weeds as fast-growing and strongly competing plants were able to accumulate high amounts of plant nutrients. The average potassium content in weed tissues was three times as high, and the nitrogen content almost twice as high as corn grown with these weeds.

Relative values for yield and total uptake of plant nutrients (Table II, Fig. 2) by corn grown alone and corn grown with weeds show striking differences. Average data for four years show that corn grown with weeds took up only 44% as much potassium, 53% as much nitrogen and produced 57% as much dry matter as corn grown alone. The data also indicate relatively high yields of weed species grown in pure cultures.

Reduction in crop yields is usually proportional to the amount of moisture, light, and plant nutrients used by weeds

at the expense of the companion cultural plants. Competition for moisture is great, and under dry conditions may be critical. During the four-year investigations, 1953 and 1955 were relatively dry growing seasons. In 1953, July, August, and September were exceptionally dry; and in 1955, July and the first part of August were marked by hot, dry weather. In both years, the competition for moisture in the corn-with-weeds plots in comparison with pure corn plots was quite noticeable. This competition is clearly expressed in the corn yield data (Fig. 2): because of the weeds, corn yields for the dry growing seasons of 1953 and 1955 were reduced 56 and 51%, respectively. On the other hand, under more normal weather conditions (1952 and 1954), the average reduction in corn yield as a result of weed competition was only 33%. It is interesting to note that in any year, yield reduction due to weeds was highly significant.

Conclusions

1. Common weeds are able to accumulate large amounts of potassium and nitrogen in their tissues in comparison with companion cultural plants, and competition for these essential plant nutrients is great. Also, weeds distinguish themselves by being comparatively rich in Ca and Mg.

2. Competition for moisture is strong, as observations and corn yield data indicate, and especially effective when moisture is limited.

3. Even at high rates of fertilization with complete fertilizers, weeds compete strongly for essential nutrients, light, and moisture. Weeds suppressed the growth of corn and resulted in significant decrease in corn yields. The data showed clearly that it is not feasible to maintain high corn yields in the presence of competing weeds by increased rates of fertilization.

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Fertilizing Alfalfa in Kentucky

(*From page* 8)

In 1954 the hay harvested from plots to which no potash had been applied consisted of approximately 50% weeds. A comparison of the stand of alfalfa between the plots which have received potash applications and those to which no potash has been applied is shown in Fig. 1.

On the higher-fertility plots (to which both phosphorus and potassium were applied) only 10% of the herbage consisted of weeds, while on the plots to which either phosphate or potash alone had been applied, 40% and 50% of the herbage, respectively, consisted of weeds. The yields reported in Table I give the total weights of all the herbage harvested from the plots, and thus, differences in the quality of the hay from the various plots are not shown. It is obvious from Fig. 2, however, that the hay from the plots which received liberal applications of both phosphate and potash was of a much higher quality than that from the plots to which only one of these two elements had been applied. This difference in the quality of the hay has been apparent since the first crop was harvested in 1950, but as the stand of alfalfa on the low-fertility plots has become progressively thinner, a poorer quality of hay has been obtained.

The effect of treatments upon the

quality of the hay is extremely important and should not be overlooked in the final analysis of the results. A palatable and nutritious forage cannot be produced unless the soil either contains an adequate supply of the necessary mineral elements or is properly fertilized to supply the needs of the crop. For instance, on the plots to which no potash was applied, approximately one half of the hay harvested at the time of the third cutting in 1954 consisted of weeds, while on the plots to which potash had been applied at the rate of 300 lbs. of K_2O per acre, only one tenth of the hay consisted of weeds. The average yields from these plots were 510 and 1,950 lbs. per acre, respectively. However, the actual yields of alfalfa, as calculated from the percentage composition of the herbage, were 300 and 1,750 lbs. per acre, respectively. Thus, although the total yield of herbage from the higher-yielding plots was only slightly more than three times that of the lower-yielding plots, nearly six times as much alfalfa was harvested. On the plots of the phosphate comparison, these same trends were apparent, but the differences were not so striking.

Adequate Nutrients a Must

Obviously, adequate supplies of both phosphorus and potassium are required to establish and maintain a stand of alfalfa and to consistently produce a high-quality, nutritious forage. What fertility practices, then, must the farmer follow if he wishes to establish a stand of alfalfa and consistently produce high yields of good hay? In the first place, a soil that is suitable for alfalfa production must be selected. As was stated previously, Kentucky farmers are now growing alfalfa successfully on soils upon which the successful production of alfalfa was formerly thought to be impossible. This does not mean, however, that alfalfa production will be successful on a shallow or poorly-drained soil. It is probable that many of the alfalfa failures which were once thought to be due to the unsuitability of the soil were actually due to nutrient deficiencies. Farmers have reported that they were now unable to get a stand of alfalfa on land where excellent yields of alfalfa had formerly been produced. But when these fields were properly fertilized, excellent hay crops were again produced.

As a summary, we might review some of the steps and recommendations toward better alfalfa production.

Test—don't guess. After a suitable soil for alfalfa production has been selected, a sample should be tested to determine its lime, phosphate, and potash needs. A higher lime content must be maintained in the soil for successful alfalfa production than is required for most of the other field crops commonly grown in Kentucky.

Apply limestone as needed. Unless the pH value of the soil is between 6.5 and 7.0, an application of ground limestone is necessary to grow the best alfalfa. Apply limestone according to soil-test indications. Enough is a must, but too much limestone is a waste and dangerous.

Starter fertilizers recommended. Next, phosphate and potash fertilizers must be applied if needed. As much as 1,000 lbs. of 0-14-14 fertilizer, or its equivalent in other fertilizers, may be required to establish and maintain alfalfa through the first cutting season on soils which are very low both in available phosphorus and potassium. Fertilizers must be chosen according to known soil deficiencies. Data from this and other experiments conducted in Kentucky definitely show that a satisfactory stand of alfalfa cannot be established without an adequate supply of phosphorus, either already available from the soil or from fertilizer phosphates. Enough potassium also must be available from the start or many alfalfa plants may die during the first season.

About 30 lbs. of nitrogen (N) per acre in the starter fertilizer, (as 1,000

lbs. 3-12-12 or 600 lbs. 5-20-20) may help in getting a better stand under low-nitrogen conditions.

Topdress to maintain stands. In order to maintain established stands of alfalfa, annual topdressings of both phosphates and potash are recommended in Kentucky. These applications should be made early in the season, usually after the first or second cutting. Up to 60 lbs of phosphate (P_2O_5) and 120 lbs. of potash (K_2O) are recommended annually, as in 600 lbs. 0-10-20.

In most cases, borax also should be applied, at rates of 20 to 30 lbs. per acre, applied biennially or half as much annually, to maintain vigor and prevent "yellow top," the symptom of boron deficiency which appears most on the second and third cuttings.

If these fertility practices are followed, with an adapted variety of alfalfa, properly inoculated and sown in a well-prepared seedbed, a good stand of alfalfa generally can be established and maintained.

Give alfalfa fair trial. Those who have never grown alfalfa but would like to try it, might include some alfalfa with their red clover and other mixed hay seedings. Alfalfa is quite drouth-resistant as compared to ladino, alsike, and red clover.

Whether grown alone or in mixtures, alfalfa given a fair trial at high-fertility levels may produce surprisingly large yields even on soils not considered best adapted for alfalfa. Good alfalfa is an extremely palatable and nutritious livestock feed, and when properly fertilized and managed, it can be one of the most profitable crops produced on the farm.

Better Soil—Better Feed

(From page 22)

urine on April 4, May 17, and June 10 at the rate of 5,000 lbs. an acre at each application. Weeds were removed from the harvested samples by hand sorting. The protein content of the grass from the treated plot remained higher than that of the untreated plot throughout the season. In June, July, and August the protein percentage of the fertilized grass was about double that of the untreated. At no time did the protein value of the fertilized grass fall much below that of good legume hay.

Is the extra protein obtained in fertilized bluegrass of value to dairy cows? Eheart and Pratt of the Virginia Station found the answer to this question by conducting 14 digestion trials with herbage from fertilized and unfertilized bluegrass pastures (6). The herbage was fed in fresh condition to dairy cows. The fertilized herbage contained 18.49% total protein and 14.08% digestible protein whereas the herbage from the unfertilized pasture had only 15.53% total protein and 11.33% digestible protein. In total digestible nutrient value, however, there was little difference between the fertilized and the unfertilized grass. In the experiments over a 10-year period, fertilization brought an annual average increase of 72% in yield of total digestible nutrients.

Blaser and co-workers at the Florida Station found that yields of unfertilized carpetgrass pastures over a four-year period averaged 2,328 lbs. of dry herbage per acre while the fields fertilized with nitrogen during a five-year period averaged 4,230 lbs. per acre (1). Pure carpetgrass herbage samples hand-plucked from eight pastures each month from May to November averaged 8.2% protein for the unfertilized grass while the average for the fertilized pastures was 10%.

Salisbury and Morrison at the Cornell, New York, Station compared timothy hay from fertilized fields with alfalfa hay as feed for dairy cows (11). The timothy was grown on 15 farms

where it had been fertilized with 250 lbs. of calcium cyanamide to the acre and cut in early bloom stage. Timothy hay grown on fertilized strips had a protein content of 9.38% while timothy from unfertilized strips on the same fields had only 7.99% protein. The nitrogen-fertilized timothy hay compared favorably in feeding value with alfalfa hay when extra protein supplement had been added to equalize the protein intake from the two rations.

Nitrogen fertilization also is likely to increase the protein content of the leaf-stalk portion of silage corn forage when the crop is grown on soils low in available nitrogen. This fact was demonstrated at the Illinois Station (7).

Phosphorus of Grasses Sometimes Increased

In the 1920's investigations in Norway (14), South Africa (13), and Minnesota (4, 5) sought to explain the unthriftiness, lack of growth, decline in milk production and reproduction, and also death of many cattle which were being pastured on native grasses. It was found that the grasses became low in calcium and especially low in phosphorus content as they approached maturity or became dry, and the condition was worse following unusually dry seasons. Correction of the malady in cattle was brought about either by applying phosphorus to the grasslands or by feeding a phosphorus supplement to the cattle.

The Elizabethtown, Illinois, Soil Experiment Field is located near the Ohio River on a light-colored soil low in available phosphorus. Soil treatments on this field resulted in yields of bluegrass hay which were from 7 to 25 times as large as those from untreated plots (12). The hay from some of the treated plots had twice as much protein and nearly twice as much phosphorus per ton as hay from the treated plots (Table III). Phosphorus fertilization also enhanced the phosphorus content of orchardgrass, redtop, and timothy hay grown on the same experiment field. In the case of grass crops grown on fields located on dark soils which were well supplied with phosphorus, fertilization with phosphorus appeared to have less influence on the phosphorus content of the hay.

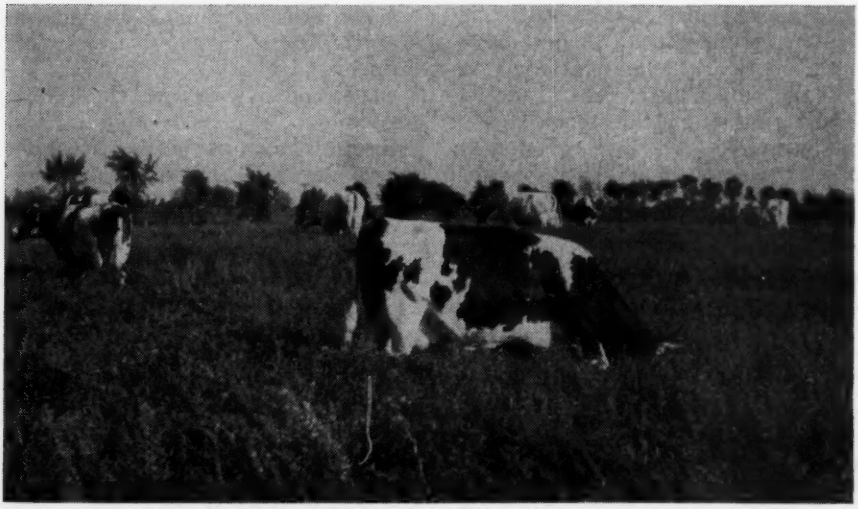

Fig. 4. Fertilization usually makes possible the establishment of legume pastures and meadows. Legume forages as a rule are higher in feeding value than the non-legumes.

TABLE III.—YIELD AND COMPOSITION OF BLUEGRASS HAY GROWN UNDER DIFFERENT SOIL TREATMENTS

Soil treatment applied	Yield per acre, lb.	Protein	Phosphorus	Potassium
		lbs. per ton of hay		
None.....	240	182	3.6	32.6
Ammon. sulphate.....	2,100	375	3.2	54.2
Uramon.....	1,790	345	4.0	56.6
Soybean meal..	1,910	348	4.0	48.8
Ammon. sulphate, sP*.	6,340	378	6.6	41.0
Uramon, sP*...	4,740	310	6.4	37.8
Soybean meal, sP*....	5,280	315	6.6	48.8

* Superphosphate.
(Ill. Agr. Exp. Sta., Bul. 518).

In Virginia experiments, fertilized bluegrass pasture forage contained 0.43% phosphorus while the unfertilized forage had only 0.25% phosphorus (dry basis), a highly significant difference (6). In five experiments on different soil types in Florida, it was found that the phosphorus, potassium, and calcium contents of carpetgrass samples were increased 78, 38, and 21%, respectively, over those of the unfertilized carpetgrass samples (2).

Wheeler of the U. S. Department of Agriculture offers a simple and plausible explanation for the differences noted in the effects produced by various rates of fertilization (15). He states that application of nitrogen, phosphorus, and other nutrients may not increase the percentage content of these constituents in the plant. In the case of phosphorus, for example, a moderate phosphate application on a phosphorus-deficient soil permits the plants to take up some of the phosphorus and make additional growth. Consequently, the percentage of phosphorus in the forage may not increase. On the other hand, if phosphate is applied at heavier rates, the percentage of phosphorus in the plants will be likely to rise.

Wheeler warns against excessive rates of fertilizer application, especially of nitrogen. Sometimes the amounts of nitrates and other compounds formed in plants receiving massive doses of fertilizer may be poisonous to stock. Danger usually can be avoided by using only those amounts of fertilizer recommended by a county agricultural agent or agricultural experiment station after a test of the soil has been made.

Summary and Recommendation

Nitrogen fertilization of various kinds of grasses in Florida, Illinois, New Jersey, New York, North Dakota, and Virginia brought about increases in yields and feeding value (protein content) of the forage. In several instances phosphate fertilization increased the amounts of phosphorus in pasture herbage or hay grown on soils low in available phosphorus. With either nitrogen or phosphorus, heavy rates of fertilization were much more effective than low rates. Soil treatment also enhanced the protein content of silage corn forage.

A first step in good livestock farm operation is to make sure that the soils producing pasture, hay, and silage forage are adequately supplied with plant food, including nitrogen, phosphorus, and potassium.

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Hearts and Hollytime

(*From page* 5)

bed. Turn on the radio to bring us some Christmas Carols, loud enough to muffle the rattling and rustling of paper parcels or the squeaking of toy dogs and the crying of dolls, as you do the honors ahead of the morning to come.

Stoke the fire again, wind the clock, pat those lumpy stockings hanging there in the flickering firelight, count your limping bank balance once more; and then heave your satisfied self on the mattress. You won't need to set the alarm clock for this coming Christmas morning. Young voices and pattering feet will be your happy reveille.

Home is the only fit place to be as the curtain rolls down on another long year of striving. It's the place to be lazy without remorse. It's the place to read old dog-eared books and poke through old collections of coins, keys, mibs, jackknives, and stamp albums. It's the place to smile at Mother once more, or else to hunt up her faded picture in the walnut dresser and lovingly smooth the quaint patch-work quilt or table scarf, stitched by patient and skillful fingers, long since quiet and at eternal peace.

"Going home" is returning to the old gate, yearning to see the old dog in the empty kennel, beckoning to old chums now too fat or fashionable to follow old trails. It's listening to the rasping chimes of the family clock as you doze off in the little bedroom with the dormer windows, trying to believe in fairies and to banish the bogies. (Like you have been doing so often all those forty years since.)

Upon awakening you listen for creaky wagon tires on the frosty snow or the clamor of lively bells on some neighbor's cutter. These return no more, with all your listening. But you do inhale the delicious batter-cake aroma, still a part of the rural ritual. In vain you hearken for Father at the staircase calling cheerfully but urgently: "Six o'clock and breakfast's ready. Time to roll out, Buckshot!"

Making things good and merry for holidays was a rugged job back in the days of our lamented Mothers. The family kitchen then was needlessly large and the floor was uneven and hard to keep clean. Water for cooking and dish washing had to be carried in from an outside well and a cistern in the summerhouse. Too often we forgot to fill the pails or split the kindling. Cooking was done over a low cast-iron stove, with a sagging oven door and no thermometer, and the pipes bubbling with creosote at the joints and chimney ring. Every few days the greasy coal-oil lamps had to be cleaned and filled. Chunks of heavy firewood dumped down with a crash upon the zinc mat holding the heater always left more sawdust and chips for Mother to sweep

up. Our dogs and cats were forever nosing in and out and spilling their food and drink. Baby chicks were nursed behind the stove on extra cold spring days. Yet I cannot recall Mother's bewailing her lot in life or mentioning the things needed to make work easier that she failed to get at Christmas.

After a long day of trudging and bending, she would stand at the threshold of the sitting-room, pushing her dark hair away from a flushed and tired face and say to us: "How nice and cozy it is to come in here and do my darning by the fire, with all my happy family around me." At this point some of us would grab her work-basket and hand her a library book to read aloud. She had such a nice, soothing voice, and she would stop and sniffle with us at the sad parts in Tiny Tim or Little Nell.

FATHER was a part of our old-time Christmas, too. He was denied a good bookish education, but he wanted us kids to have a few books at Christmas time that might inspire us to acquire the learning he had missed. As I think it over now and recall the books he gave us, it seems he must have had a list made out by Mother. On my shelf today are a few leftovers from boyhood fiction favorites. Here is one of them, bound in faded red cloth, with coarse, thick brown leaves. Its title is "Tanglewood Tales from Hawthorne." On the flyleaf in Mother's hand is, "Christmas 1900 from your Father with best wishes." But on the back inside cover is a small pasted label, "I was bought at the Fair Store," and a dim notation by the clerk, "25 cents."

Pray tell me, after all, what was 25 cents when you wanted to give your kid a pretty good story book for Christmas? You never had one so good as this years ago when books were scarce, and you wouldn't miss that 25 cents six weeks later. This may have been his train of thought as he fumbled among the cheap little offerings at the Fair Store so long ago.

Since that day, on many occasions I have met these same old heroes of Hawthorne's classic fables, dressed in much finer garb and presented in nobler, well-illuminated folios. Yet the Golden Fleece, the greedy Minotaur, and Ulysses and the sirens have never stepped forth in more enthralling pageantry than they did when I first read that little book at Christmas more than fifty-five years ago. It's the giver and not the gift that we remember.

You are also willing to testify that the old, the simple, and the tender things remain the longest in Christmas memories and leave us more fully satisfied. So many hard-pressed parents live and die in relative obscurity, and the depth and courage of their devotion lasts so short a time in the passing generations.

In our design of living we are like the farmer. Regularly he plows and plants and cultivates the soil for a hopeful harvest and carries on his humble plans in a spot of little world-wide consequence. In that same way, a majority of us have no power or prestige or influence upon the affairs of men. Yet we have some inner light and some good will that each Christmas makes stronger. We merely do our part in the local sphere, trying to understand and uphold the fine traditions and basic values that belonged to domestic tranquility in the days gone by.

LET'S take hands around wherever we are and keep alive these best things that linger in our memories since the days of our youth. We may think that too much has been added, or more than necessary has been taken away from the holiday spirit. But times change and men want more to make them happy than they did before. Yet we still believe that the truth and simplicity of kindness and good will are the most valuable and helpful packages we can tote to our associates this Christmas morning.

FREE LOAN OF EDUCATIONAL FILMS

The American Potash Institute will be pleased to loan to educational organizations, agricultural advisory groups, responsible farm associations, and members of the fertilizer trade the motion pictures listed below. This service is free except for shipping charges.

FILMS (ALL 16 MM. AND IN COLOR)

The Plant Speaks Thru Deficiency Symptoms (Sound, running time 25 min. on 800-ft. reel.)

The Plant Speaks, Soil Tests Tell Us Why (Sound, running time 10 min. on 400-ft. reel.)

The Plant Speaks Thru Tissue Tests (Sound, running time 14 min. on 400-ft. reel.)

The Plant Speaks Thru Leaf Analysis (Sound, running time 18 min. on 800-ft. reel.)

Save That Soil (Sound, running time 28 min. on 1200-ft. reel.)

Borax From Desert to Farm (Sound, running time 25 min. on 1200-ft. reel.)

Potash Production in America (Sound, running time 25 min. on 800-ft. reel.)

In the Clover (Sound, running time 25 min. on 800-ft. reel.)

In Canada: The Plant Speaks Thru Deficiency Symptoms
The Plant Speaks, Soil Tests Tell Us Why
The Plant Speaks Thru Tissue Tests
The Plant Speaks Thru Leaf Analysis
Borax From Desert to Farm
Potash Production in America

DISTRIBUTORS

Northeast: Educational Film Library, Syracuse University, Syracuse 10, N. Y.

Southeast: Vocational Film Library, Department of Agricultural Education, North Carolina State College, Raleigh, North Carolina.

Lower Mississippi Valley and Southwest: Bureau of Film Service, Department of Educational Extension, Oklahoma A & M College, Stillwater, Oklahoma.

Midwest: Visual Aid Service, University Extension, University of Illinois, Champaign, Illinois.

West: Department of Visual Education, University of California, Berkeley 4, California.

Department of Visual Education, University of California Extension, 405 Hilgard Ave., Los Angeles 24, California.

Department of Visual Instruction, Oregon State College, Corvallis, Oregon.

Bureau of Visual Teaching, State College of Washington, Pullman, Washington.

Canada: National Film Board, Ottawa, Ontario.

For the Province of Ontario: Distribution Services, Ontario Agricultural College, Guelph, Ontario.

IMPORTANT

Requests should be made well in advance and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of loan.

Request bookings from your nearest distributor.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Reprints

3-1-56 Potash in Agriculture
S-5-40 What is the Matter with Your Soil?
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
A-1-44 What's in That Fertilizer Bag?
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—The Aristocrat
ZZ-11-45 First Things First in Soil Fertility
T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
TT-11-47 How Different Plant Nutrients Influence Plant Growth
AA-6-48 The Chemical Composition of Agricultural Potash Salts
GG-10-48 Starved Plants Show Their Hunger
SS-12-49 Fertilizing Vegetable Crops
BB-8-50 Trends in Soil Management of Peach Orchards
X-8-51 Orchard Fertilization Ground and Foliage
BB-10-51 Healthy Plants Must Be Well Nourished
II-12-51 Pasture Improvement With 10-10-10 Fertilizer
KK-12-51 Potassium in Animal Nutrition
A-1-52 Research Points the Way to Higher Levels of Peanut Production
Y-10-52 The Nutrition of Muck Crops
CC-12-52 The Leaf Analysis Approach to Crop Nutrition
I-2-53 Sericea Is a Good Drought Crop
J-3-53 Balanced Nutrition Improves Winter Wheat Root Survival
K-3-53 Kudzu Keeps Growing During Droughts
N-4-53 Coastal Bermuda—A Triple-threat Grass on the Cattleman's Team
P-4-53 Learning How to Make Profits from Sweet Potatoes
T-5-53 Trefoil Is Different
DD-10-53 Sampling Soils for Chemical Tests
II-11-53 The Importance of Legumes in Dairy Pastures
JJ-11-53 Boron—Important to Crops
MM-12-53 White Birch Helps Restore Potash-Deficient Forest Soils
K-2-54 Soil and Plant Analyses Increase Fertilizer Efficiency
R-3-54 Soil Fertility (Basis for High Crop Production)
U-4-54 Nutrient Balance Affects Corn Yield and Stalk Strength
CC-6-54 Fertility Increases Efficiency of Soil Moisture
EE-8-54 Red Apples Require Balanced Nutrition
FF-8-54 Apply Fertilizers in Fall For Old Alfalfa, Grass Pasture and Timothy-Brome Fields
JJ-10-54 Principles Involved in Soil Testing
LL-10-54 Relation of Fertilizer to Quality and Yield of Flue-cured Tobacco
MM-10-54 Longer Life for Ladino
SS-11-54 Foliar Application of Plant Nutrients to Vegetable Crops
YY-12-54 Physical Condition of the Soil Affects Fertilizer Utilization
A-1-55 Potash-Deficiency Symptoms
C-1-55 Summary of Ten Years' Work with Complete Fertilizers on Sugar Cane
D-1-55 Nitrogen Use Accentuates Need for Minerals
G-2-55 Seven Steps to Good Cotton
H-2-55 Apparent Fertility Trends in Western Irrigated Soils
L-3-55 Soybean Production in the Southern States
P-3-55 N-P-K for Deciduous Fruit Trees
S-4-55 Greener Pastures Mean Better Living
U-4-55 Fertilizer Recommendations—Burley Tobacco
V-4-55 Planned Nutrition for Canning Tomatoes
W-5-55 The Production of Sugar Beets on Organic Soils
X-5-55 What Is Happening to Our Citrus Soils?
Y-5-55 Pasture Improvement Through Renovation
Z-5-55 Azalea Fertilization
EE-10-55 Fertilizing For Better Apples
HH-10-55 Fertilizers Will Cut Production Costs
LL-12-55 Potassium Deficiency of Alfalfa in California
A-1-56 Why More Alfalfa?
B-1-56 Certain Practices Are Important for Successful Pecan Production
C-1-56 A Successful Corn Crop on the Same Land Every Year Is a Possibility
D-2-56 Give Fertilizers A Chance
E-2-56 Fertilizer Statistics From the 1954 Census of Agriculture
F-2-56 Fertility-lime Status of Mississippi Soils
G-2-56 Plant-food Content of Crops—Guide to Rotation Fertilization
H-3-56 The Application of Fertilizers in Irrigation Waters
I-4-56 Surveying Corn Fields by Tissue Tests
J-4-56 The Relation of Potassium to Fruit Size in Oranges
K-4-56 The Value of Green Manure Crops in Farm Practice
L-5-56 Give Your Plants a Blood Test—Guide to Quick Tissue Tests
M-5-56 The Placement of Fertilizer for Peanuts
N-5-56 Fertilizer Placement for Corn in Minnesota
O-6-56 Plant Analysis As a Guide to Fertilization of Crops
P-6-56 The Use of Minor Elements for Organic Soils
T-10-56 Withdrawals from the Soil Bank—Pacific Northwest Crops
U-10-56 Fertilizer and the Florida Farmer

THE AMERICAN POTASH INSTITUTE

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Hortense was fuming as she burst into her neighbor's house one morning and stormed indignantly, "I'm so mad at Horace I don't know what to do!"

"Why?" asked her friend.

"Last night I dreamed that some blonde hussy was flirting with him, and he was purring like a kitten."

"Now, Hortense," the neighbor consoled, "it was only a dream."

"Well," Hortense exploded, "if he acts like that in my dreams, what in the world do you suppose he does in his?"

* * *

The housewife was still sitting at the breakfast table, having her 8th cup of coffee and trying to decide whether to get dressed, wash the dishes, or maybe look at television when she heard the garbage man outside. She dashed through the back door, her hair in curlers, face unmade, and wrinkled old bathrobe askew.

"Am I too late for the garbage," she asked.

Garbage man took one look and said, "No, mam, jump right in."

* * *

Mose was down by the river bank watching the parson baptize his friend, Sam, in the icy waters. When the pastor raised Sam to the surface Mose asked him:

"Is the water cold, Sam?"

"Noo-oo-o," chattered Sam.

"Better duck him again, pahson," advised Mose, "he ain't stopped lyin' yet!"

Then there was the Scotsman who was plenty embarrassed. He could have sworn the sign on the door read: "Laddies."

* * *

He was driving down a busy street when his eye was caught by two shapely girls on the sidewalk. Luckily he was driving only ten miles an hour—because he failed to see the light turn red, and rammed the car ahead.

The door of the car in front opened, and a tall muscular man began to unfold himself in sections. He walked purposefully toward the other car and put his large hands on the window ledge. Sticking his head through the window, his voice boomed: "That's okay, buddy, I was watchin' 'em too!"

* * *

"Goodnight," she purred at the door, "It was fun 'Noing' you."

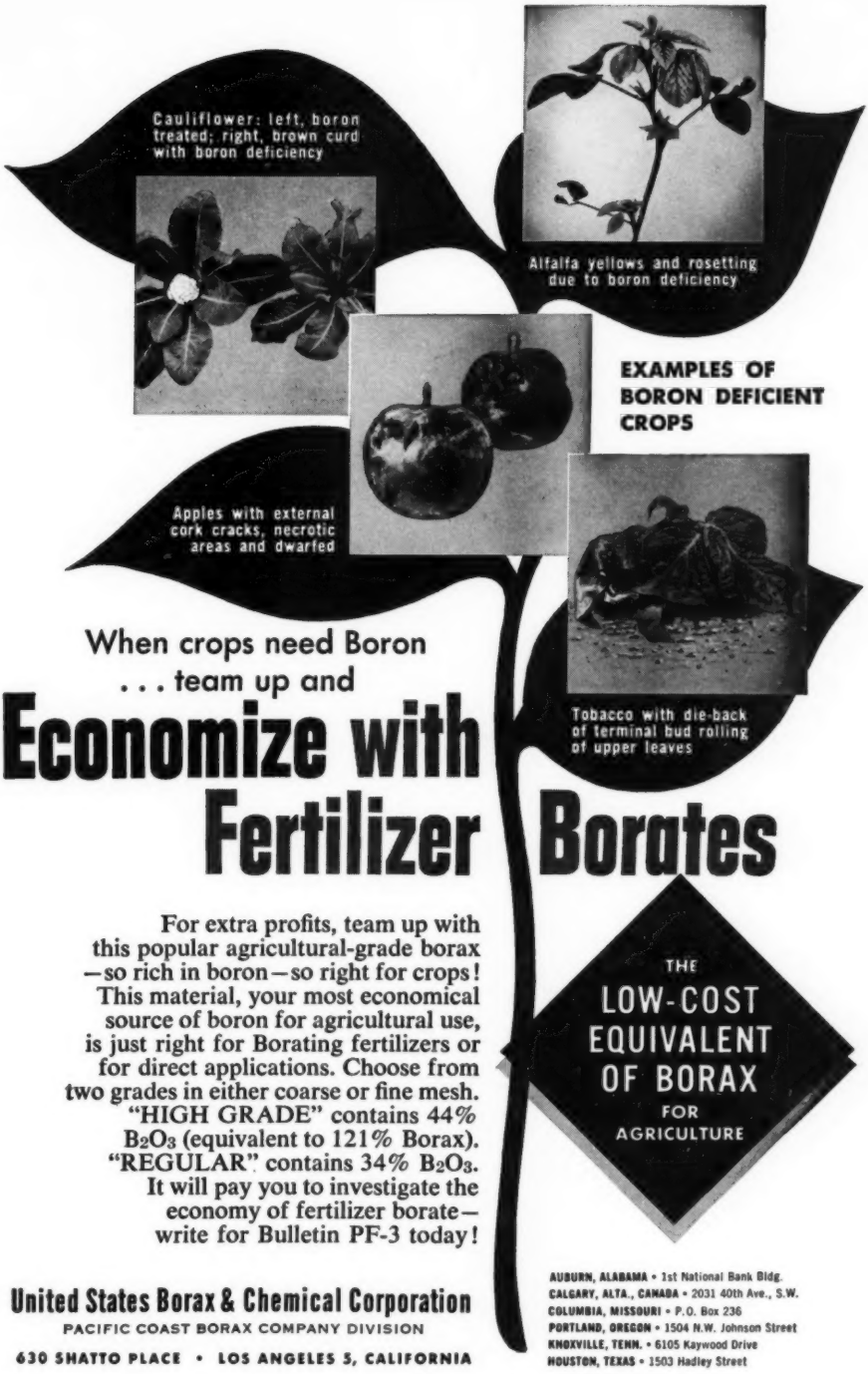
* * *

At a big livestock show, a city man watched the dairy hand grooming a Holstein cow for the show ring. Presently the city man asked, "What's the cow's name?"

"It's Cynthia Rosabella DeJerquine the sixth of Susquennah Hill."

"Isn't that pretty long?"

"Mister," retorted the bovine groom, "when you play chambermaid to a bunch of milk cows, you got lotsa time for talk."


Cauliflower: left, boron treated; right, brown curd with boron deficiency
Alfalfa yellows and rosetting due to boron deficiency
EXAMPLES OF BORON DEFICIENT CROPS
Apples with external cork cracks, necrotic areas and dwarfed
Tobacco with die-back of terminal bud rolling of upper leaves

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